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By F. H. WHITLEY
Instructor in Sanitary Engineering
New York University

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JULY CONTENTS

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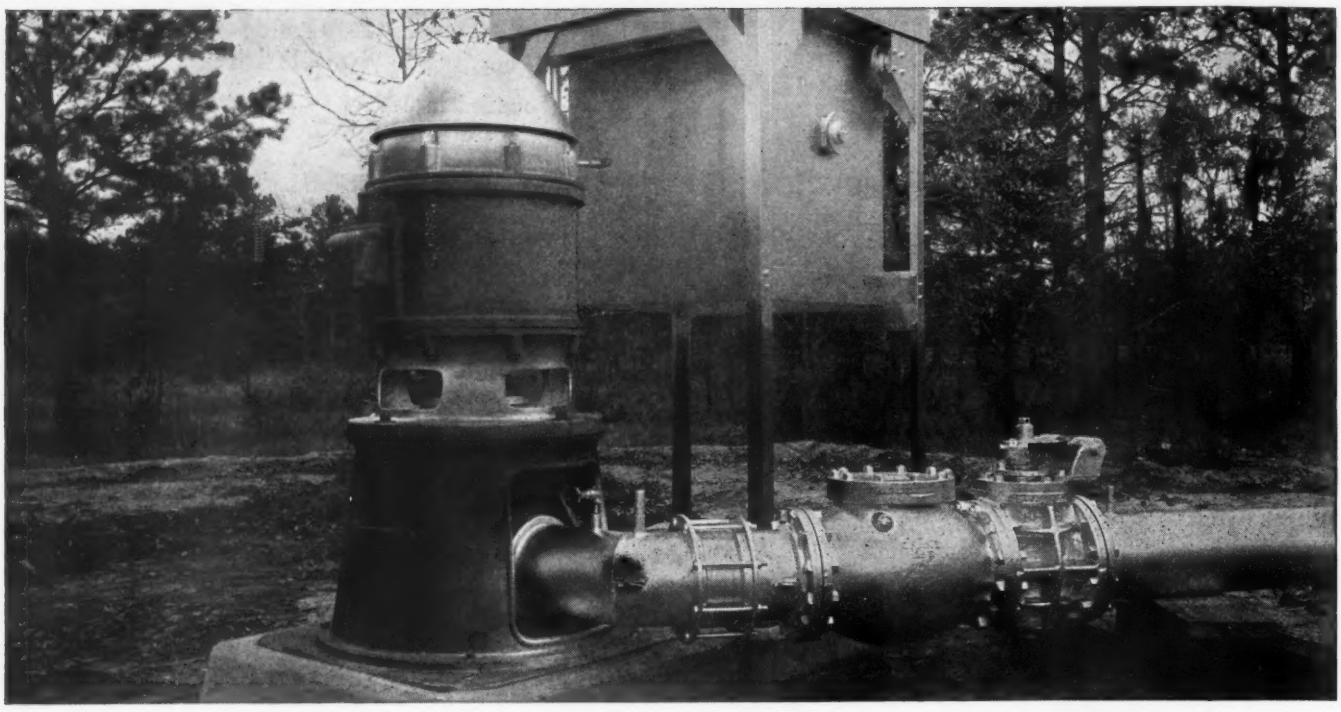

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When you need special information—consult the *classified* READER'S SERVICE DEPT., pages 55-57

The Editor's Page

Priorities for Public Utilities

Scarcity of some materials needed for defense production is beginning to be realized, and the word "priority" and the letters OPM are likely to become as familiar to many classes of our citizens as PWA and WPA. There probably will be no difficulty in obtaining essentials for municipal water supplies, sewerage, and refuse collection and disposal; but even for these, officials should not expect unlimited and unnecessary requests to be met. Extending distribution systems to provide for populations expected ten years or more hence; replacing pumps that can still operate for some years but perhaps not so efficiently as new ones; in short, using materials this year for work that can be postponed without detriment to public health or safety, will probably be ruled out by the boards at Washington.

It is evident that requests for certain types of material will have to be reviewed in the light of availability of substitute materials. These substitute materials apparently will be considered in the light of their ability to render reasonably equal service for a time even though their ultimate life will be less than the higher grade material originally requested.

For what materials priorities will be necessary, what board to apply to and how, are matters that have not yet been definitely decided, or at least announced. To assist those in the waterworks field, the American Water Works Association has created a "Committee on Defense" which is obtaining data concerning the materials and supply situation within the water supply field, which it will present to the proper authorities in Washington with a view to facilitating the obtaining of priority rulings favorable to water supplies. Any water works man who finds hmself unable to obtain necessary supplies or materials is requested to write or wire the association's office giving the facts—and facts only—the materials needed, the name of the firm which claimed to be unable to fill his order for them (with this claim made in writing by them), and the reason why they are considered necessary.

High-Grade Executives Needed for Defense

It is not often that the Civil Service Commission has $8,000 positions to offer, and men receiving such high salaries therefore seldom think of looking at the Commission's notices. For this reason, and because of the urgent need for such men in the national defense, we are placing this notice on the editorial page. The notice received from the Commission is as follows:

A notice of particular interest to persons experienced in management of important private or public enterprises has been received from the Civil Service Commission, Washington, D. C. Announcement is made of examinations for filling five grades of administrative positions, mostly in national defense agencies, as follows: Executive Officer, $8,000; Chief Administrative Officer, $6,500; Principal Administrative Officer, $5,600; Senior Administrative Officer, $4,600; and Administrative Officer, $3,800 a year. Positions at these levels are the very highest ordinarily filled through civil service. The standard of requirements is correspondingly high.

No written examination is required but to be eligible a person must show experience, acquired either in public or private employment, involving important and extensive administrative responsibility, or broad experience as a successful consultant or adviser in public or business administration, scientific or industrial management. The length of the experience required varies—a minimum of 9 years for the lowest grade, and graduating upward for the higher grades. The degree of administrative responsibility required also increases with the grade of the position. Under-graduate and pertinent graduate study in a recognized college or university may be substituted for a part of the experience.

An unusual feature of these examinations is the preliminary classification. Applicants' qualifications will initially be given a tentative rating as to eligibility only. If found eligible, they will be classed in appropriate categories of administrative skills and fields of substantive knowledge. Final rating will not be made except in terms of specific needs. When request is made for administrative officers with a special administrative technique (such as budgeting) and with particular substantive knowledge (such as the generation and distribution of electric power), persons in the appropriate classifications will be finally rated as to eligibility and as to salary level and numerical rank within each level. Personal qualifications and suitability form a part of the requirements for eligibility, such as loyalty, honesty, address and appearance, capacity to accept and fulfill responsibility, etc.

A new procedure will be followed by applicants in applying for these examinations: Upon ascertaining the requirements through the official announcement (Announcement 100) they will be required to obtain a simple card form (No. 4000-ABC), fill it in, and submit it to the U. S. Civil Service Commission, Washington, D. C., on or before July 21. Upon receipt of the card form, the Commission will furnish applicants with the additional application material to be used by them in submitting their statements of qualifications. Form 4000-ABC with information concerning the requirements may be obtained from the Secretary, Board of U. S. Civil Service Examiners, at any first- or second-class post office; or a copy of Announcement 100 with Form 4000-ABC may be obtained from the U. S. Civil Service Commission, Washington, D. C., or from any of the Commission's district offices.

THE NECESSITY OF THE DEFENSE EFFORT OF THE UNITED STATES IS WELL KNOWN. THERE IS A HIGH PREMIUM ON COORDINATED EFFORT. ADMINISTRATORS AND STAFF ASSISTANTS ARE NEEDED TO PROVIDE THAT COORDINATION. IF YOU HAVE THE EXPERIENCE AND THE ABILITY REQUIRED, **APPLY NOW.**

PUBLIC WORKS Magazine . . JULY, 1941

VOL. 72. NO. 7

Courtesy N. J. State Highway Dept.

Fig. 1—Transportation efficiency seriously crippled by intersectio.s, narrow width and lack of medial divider, insulating service streets and adequate right of way.

BYPASS HIGHWAYS

By CHARLES M. NOBLE

Special Highway Engineer, Pennsylvania Turnpike Commission

THERE is a widespread belief that highways bypassing cities and towns are uneconomic and obsolete and that the express type highway into and through the heart of populated areas is the only solution for traffic congestion. This opinion is held because of the overshadowing volume of traffic destined for the city itself when compared with the volume of through vehicular movement; also, that the provision of bypass facilities for the small volume would not help the greater, whereas provision for the greater volume into and through the center of congested areas might solve both. The opinion has been strengthened by numerous examples where bypass routes have failed to solve troublesome traffic problems permanently. It is the writer's belief, and this belief also is expressed in "Toll Roads and Free Roads,"* that the bypass highway is still an important and necessary element in highway transportation. But it is essential that it be designed along modern principles in order to safeguard the investment against early obsolescence and loss in transportation efficiency; and the designer must differentiate carefully those conditions to which it is adapted from those where it will serve no useful purpose.

By and large, the highway system of the United States must fulfill the desires and meet with the approval of the motoring public, otherwise there will be a loss of confidence by the public in the wisdom and ability of highway administrators and this will even-

*Report of Bureau of Public Roads, 1939.

Courtesy N. J. State Highway Dept.

Fig. 2—Medial divider aids in traffic safety and in expediting traffic flow, but lack of insulation and grade separation will lower transportation efficiency of this expensive highway.

tually result in a curtailment in highway funds. Consequently, there has been an increasing trend in recent years to plan, design, and construct highway facilitities that cater to the desires and preferences of the motorist. The average motorist desires a facility which will enable him to reach his destination within a reasonable period of time without irritating delays and nerve wracking congestion. The through motorist, for example, would prefer to avoid passing through the center of every town and city en route to his destination, and further, would prefer to avoid the attendant traffic congestion, intersecting street grade crossings and traffic lights which characterize so-called bypass routes marked out by signs through the outskirts and residential areas of cities and towns. Numerous instances have been observed where motorists will select longer and more out-of-the-way routes, which offer more pleasant operating conditions, than direct routes through congested areas. It is, therefore, believed that wisely planned, correctly designed, and safeguarded bypass highways will meet overwhelmingly with public approval and will obtain the enthusiastic support of motorists generally.

Assuming that it would be financially possible to provide every city in the United States having a population of 75,000 and upwards immediately with an express type highway with limited access and all grades separated constructed into and through the center of population, it would be quickly discovered that there still would be situations where such facilities would not meet the preferences and desires of the through traveler, for in spite of the excellence of the express facility, he would be subjected to traffic congestion and the nerve tension attendant thereto. Experience has shown that express routes constructed in congested areas are loaded nearly to capacity when first opened to traffic and the through traveler would prefer to avoid these congested arteries and bypass the city via a highway which would provide open highway facilities free of traffic congestion. Thus the bypass highway would still meet with public favor and use in spite of the availability of an express route through populated centers.

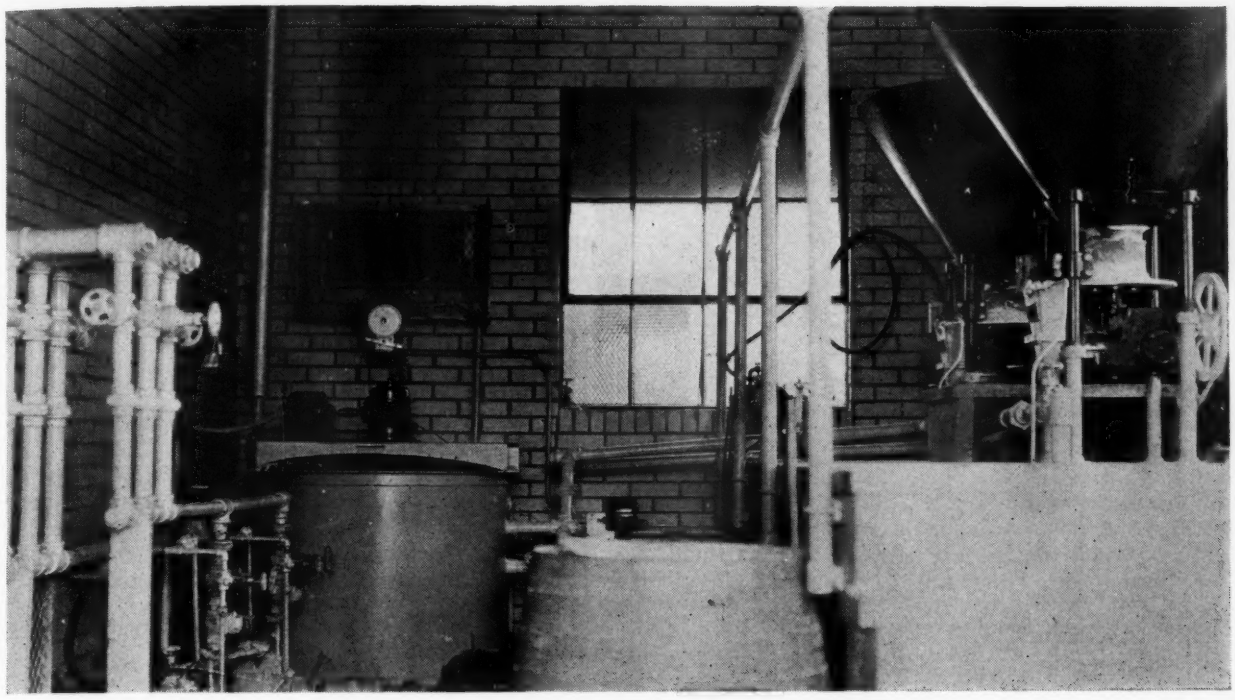
Anyone famliar with the financial difficulties of public officials in obtaining sufficient funds to carry on current routine highway programs, will realize the obstacles in procuring immediately express routes through the center of all highly developed populated areas throughout the United States. Furthermore, the problem is intensified by the high cost of such construction and the large property damage involved. For these practical reasons, it may be assumed, however great the need, that it will be many years before all cities are equipped with express highways.

In the meantime, congestion continues to grow and through traffic increasingly feels the bottleneck effect of the cities and towns it is forced to struggle through at the expense of considerable expenditure of nervous energy and loss of time. This problem can be remedied in many cases where conditions are favorable by the construction of properly designed bypass highways located sufficiently clear of built-up areas to avoid expensive land costs, yet readily accessible to the city, and it would thus be possible to afford relief to through traffic at an expenditure which could be obtained from current revenues in the immediate future. Critics will point out that the volume of the traffic bypassed around the larger cities is such a small proportion of the total volume entering, leaving, and circulating within the city that the favorable effect of the bypass on the city traffic problem will be negligible, so that the benefit

(Continued on page 32)

Courtesy N. J. State Highway Dept.

Fig. 3—This bypass was originally constructed virtually through open undeveloped rural country to carry traffic around a town of moderate size. The mushroom development has occurred in the intervening 17 years.



Lime and Calgon plant of Freeport, Long Island, N. Y.

My Experience With Lime and Calgon in the Prevention of Corrosion

By A. C. SOUTHARD
Manager, Water Dept., Freeport, Long Island

IN MARCH, 1939, we put into operation Wallace and Tiernan lime feeder equipment. The type feeder that we use is a rotary table, water siphon and mixing tank to which the lime from the feeder is carried by the water, through the siphon. At this point the lime becomes thoroughly mixed into the water and solutionized to a degree that will readily pass through a small centrifugal pump. The mixing process is accomplished by the aid of an electric motor-driven agitator.

The lime solution passes from the mixing tank to an electric motor driven centrifugal pump that forces the solution up through riser pipes to a point above the full tank water level, and is carried to a point directly under the aeration trays over which the water from the wells passes, and is deposited into the storage tank with the well water. All of the equipment is both automatically and manually controlled, and so arranged as to operate in unison with the supply well pumps.

All was working very satisfactorily for about three months and then trouble began. The pumps began to seize up with a hard lime deposit that completely stopped them from working. It was then necessary to take them apart and clean the lime accumulation out; but in a short time thereafter the water control and check valves in the plant also became clogged. So great was our trouble that it became necessary to shut down the lime plant for cleaning on an average of every five weeks, causing an interruption in the lime treatment of from two to four days.

We complained about this condition to the Wallace and Tiernan Company. They in turn set about to find a remedy, and asked for and got my consent to try an experiment.

On October 28th, 1939, we installed a Wallace and Tiernan Company hypochlorinator machine for feeding Calgon solution in connection with the lime. We used a very light dosage of Calgon, ⅛ of one part per million, from November 1, 1939, until early in February, 1940, with a very noticeable improvement in the lime condition in the pumps and pipes. We then increased the Calgon dosage from ⅛ to ¼ part per million.

During the month of March, 1940, we took apart all pumps, pipes and valves for a cleaning, having the work completed and plants back in service March 25, 1940. Thanks to Calgon, we have not experienced an interruption in our lime equipment from that day to the present; our machines are still performing perfectly.

We are feeding lime at approximately 117 lbs. per million and the Calgon at 2 lbs. per million, with the result that the pH value of the water has increased from 5.2 to an average of 7.2 to 7.6 at the far ends of our distribution system, with a satisfied public.

I. Russell Riker.

Improving Operation and Reducing

By I. RUSSELL RIKER
Engineer. Borough of Princeton, N. J.

THE Princeton sewage treatment plant was placed in operation in October, 1932. Records on the operation have been kept in detail from January, 1933, until the present time. These records are shown on the tabulation accompanying this article, figures for each month of the year 1940 being given and a summary for each year since the plant was placed in operation.

The plant, as originally constructed, consists of a main pumping station in which the sewage is lifted 77 feet to a one-story settling tank of two compartments. Chlorine is added to the raw sewage as it enters the settling tank. Sludge is drawn daily from the settling tank to a separate sludge digestion tank. The liquid from the settling tank passes through a dosing tank and then to a sprinkling filter, which in turn discharges into a secondary settling tank. Between the sprinkling filter and the secondary settling tank, chlorine is again added. From the secondary settling tank the effluent discharges into the Millstone river which is a source of potable water supply. The sludge from the separate sludge digestion tank is drawn from the tank as frequently as possible on to ten glass-covered sludge beds and, when dry, is removed and mixed in a compost pile with leaves collected from the streets of the municipality. When the compost pile is well conditioned, the compost is ground by a sludge grinding machine and then used for soil conditioning and as fertilizer.

The plant was designed for a population of 18,000 and a sewage flow of two million gallons per twenty-four hours. The original cost was approximately $230,000 including the pumping station. It serves Princeton Borough, Princeton Township, and Princeton University. The Borough financed the first cost of the plant and each year places in its budget an amount equal to the estimated cost of operation. The University and Township are billed each year a portion of the total cost of operation plus interest and amortization of bonds. The percentage that each party pays of the total cost is based on the ratio that the water consumption of each party bears to the total metered water consumption of the three parties.

Alterations and Additions to Plant

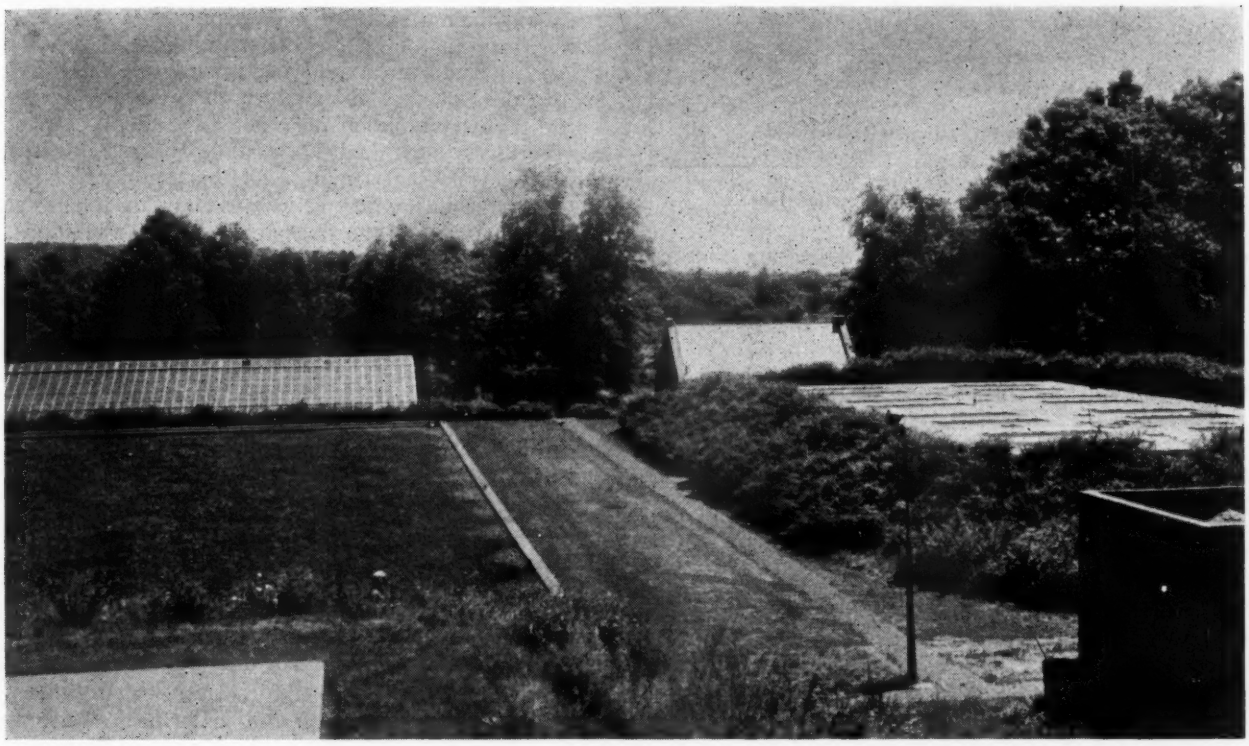
Several years ago we added a tower 9 feet high and 2 feet in diameter made of tile pipe. The tower is kept filled with tin cans and a chlorine solution is run through it by means of a hose to the bottom of the tower. The solution flows up through and around the tin cans until it reaches the top, where it overflows through a rubber hose into the raw sewage. In this manner we secure an iron salt solution which has not only been successful in helping keep down the odors but forms a heavy floc and helps settle the raw sewage. We also find that it helps sludge digestion. This treatment, which was started as an experiment, is carried out only during the summer time.

Our second addition was the construction of a supernatant water conditioning tank to which the supernatant water from the sludge digestion tank is pumped. Formerly, this overflow was discharged into the raw sewage but it was found that it interfered very much with settling. Later, it was diverted to the dosing tank for the sprinkling filters but again it proved too much of a load on the sprinkling filters. A third method of disposal on the sludge bed was also unsatisfactory, inasmuch as it seemed to seal the voids in the bed. Now, when the supernatant is badly charged with solids, it is pumped to the conditioning tank and treated with alum, and the clear water is drained into the raw sewage or dosing tank. We do

MONTH	SEWAGE FLOW MIL GALS	HOURS PUMPS IN OPERATION NO 1	NO 2	NO 3	POWER KW	GAS ENG HR. OPER	SCREENINGS CU FT	PRIMARY TANK CU FT SLUDGE REMOVED	DIGESTION TANK SLUDGE CU FT DRAWN	RANGE PH	AVERAGE TEMP	SUPERNATANT WATER GALS REMOVED	SLUDGE BEDS CLEAN	FILL	FINAL TANK CU FT SLUDGE REMOVED	MONTH
JANUARY	35.1	205.0	254.7	1.4	18416	30	62	21159	2633	6.9	54°	137000	7	4	800	JANUARY
FEBRUARY	40.1	154.7	386.3		18052	40	58	20166	6932	6.8	54°	106833	7	8	700	FEBRUARY
MARCH	67.1	163.3	644.0		27830	40	64	20092	7220	6.9	52°	165000	9	11	650	MARCH
APRIL	77.2	334.5	644.7		30601	30	60	20160	6865	6.4	49°	147200	13	12	750	APRIL
MAY	54.9	565	552.3		21848	30	64	23436	9266	6.5	55°	182500	15	16	800	MAY
JUNE	40.1	362.2	231.8		18020	40	60	29824	5766	6.7	57°	191075	11	9	1100	JUNE
JULY	22.8	311.4	7 1.3		11092	40	62	22164	3866	6.9	64°	98000	5	5	640	JULY
AUGUST	22.8	394.9	122		11612	30	62	19130	5082	6.9	63°	145500	8	7	725	AUGUST
SEPTEMBER	32.9	306.3	182.3		14390	40	60	16896	6533	7.1	66°	156500	8	9	900	SEPTEMBER
OCTOBER	34.4	86.9	516.0		14952	30	60	16460	4532	7.3	64°	135000	7	8	600	OCTOBER
NOVEMBER	51.2	362.2	231.9		22042	40	60	19824	5766	6.7	57°	191075	7	7	1100	NOVEMBER
DECEMBER	30.0	74.0	501.8		21360	40	62	16994	4731	7.3	63°	197325	8	7	700	DECEMBER
1940 TOTAL	526.6	2811.9	4215.4	1.4	228015	7.5	734	236435	68990	6.8	58°	1803008	103	101	9465	1940 TOTAL
1939 TOTAL	495.7	2660.8	3702.3	83.3	214404	3.6	730	239572	78643	6.9	61°	1717323	109	107	6200	1939 TOTAL
1938 TOTAL	567.7	1995.6	4657.7	166.8	226868	44.4	733	225882	99633	7.0	62°	1636227	124	126	7800	1938 TOTAL
1937 TOTAL	487.7	3295.5	3443.3	NONE	206378	40	730	240491	95099	6.9		1552208	121	121	8950	1937 TOTAL
1936 TOTAL	483.7	2866.8	4126	25.5	198941	28.5	732	148163	106261	7.4	60°	984358	127	125	10665	1936 TOTAL
1935 TOTAL	456.6	3166.6	2886.2	130.0	188526	23.0	730	130165	75417	7.6	68°	825225	103	101	17880	1935 TOTAL
1934 TOTAL	474.8	434.1.1	2353.3	142.1	193286	32.2	734	150636	46730	7.7	59°	716500	108	111	23242	1934 TOTAL
1933 TOTAL	487.8	5813.0	1582.0	130.6	193244	22.8	700	105763	8075	7.1	59°	1138000	21	25	28434	1933 TOTAL

Costs at the Princeton Sewage Treatment Plant

Developments during eight years of operation. Conditioning tank for supernatant; reducing size of dosing tank and dividing sprinkling fllter; coagulating filter effluent; using plant effluent. Data of operation and operating results.

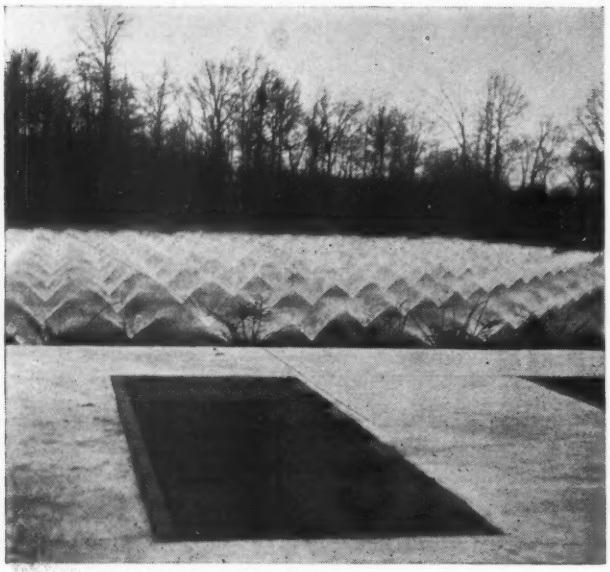


View of Princeton sewage treatment plant, showing a section of the sprinkling filter, sludge beds and digestion tank and roof of operation house. Note ornamental shrubbery.

not always have to use this conditioning tank, inasmuch as the supernatant is often quite clear.

The capacity of the dosing tanks for the sprinkling filters was next cut in half in order to reduce the time of discharge and resting periods. This, we found, improved the operation of the filters, particularly during the summer when the University closed and the dry season started and the flow decreased to less than a million gallons per day, or half the capacity of the plant. An arrangement was made to use the entire

CHLORINATION PRE LBS	CHLORINATION PRE AVPPM		CHLORINATION POST FECL LBS	CHLORINATION POST AVPPM	AVRES	FINAL EFFLUENT AVERAGE DSOX	SAT	O.D	R.S.	TURBITY	NO3	AVER PERCC 37COL	BCOL	FLOW OF RIVER MIL. GALS	RIVER AVR 37COL PER C.C. ABOVE	BELOW	AVR BCOL PER C.C. ABOVE	BELOW	TEM. AIR MAX	MIN	AVER TEMP SEWAGE	RAIN FALL INCHES	COST OF OPERATION PER MILLION GALS PUMPING	TREATMENT
			1208	0.4	0.48	8.00	6.4	138	90	20.		40	0	1618	157	146	2.3	2.7	55	13	43	1.52	$12.94	$22.06
			1191	3.7	0.48	7.12	6.0	155	90	20.		42	0	3911	202	156	4.9	1.8	59	13	46	2.94	11.08	27.52
			1478	2.8	0.37	6.26	5.3	182	90	18.		49	0	8503	228	157	3.0	2.6	54	15	46	4.72	7.74	13.61
			1298	2.3	0.21	8.28	5.8	198	90	18.		26	0	10753	127	91	2.4	1.1	74	25	51	5.24	7.35	11.55
1108	14.3		1454	3.2	0.23	4.25	4.9	122	90	22.		27	0	8718	97	76	2.3	1.6	88	41	57	5.93	8.89	20.81
3990	14.7	+	1498	3.0	0.56	4.31	4.6	212	90	28.		42	0	4237	125	109	1.2	8.8	92	56	64	1.90	12.90	25.30
2883	14.8	+	1149	6.1	0.43	4.30	4.9	153	90	25.		32	0	1060	188	110	3.0	2.8	98	54	68	1.14	17.50	41.25
3582	19.5	+	1147	6.4	0.64	8.12	7.2	176	90	22.		31	0	1202	158	141	1.5	1.8	92	57	68	5.54	17.30	36.70
3008	11.9	+	1162	4.8	0.50	6.01	6.7	149	88	21.		35	0	3516	232	180	4.4	3.1	82	40	65	8.17	12.58	31.24
948	15.2	+	1137	2.7	0.20	5.72	5.9	149	90	19.		32	0	1701	283	214	2.0	1.5	79	27	60	2.15	12.39	28.61
3990	14.7		1498	5.3	0.60	5.98	5.8	179	90	18.		31	0	5754	228	170	3.3	4.6	71	23	55	3.98	9.85	19.15
			1415	3.7	0.45	6.80	6.0	138	90	19		33	0	8349	208	160	12.8	8.3	62	12	55	3.02	8.50	23.10
19320	15.0		15837	3.7	0.43	5.93	57.7	153	90	20.6		35	0	553220	186.0	140	3.8	2.7	98	12	560	44.23	11.55	20.45
17496	12.8		13416	4.2	0.44	5.18	58	185	90	24.7		69.8	0.2	534680	285.0	211	5.93	4.7	95	10	57.0	42.75	11.00	23.00
12529	7.0		13328	3.4	0.40	5.63	57.6	180	90	26.4		111.9	0	579635	205.4	162	5.9	4.9	95	7	56.6	49.46	10.72	21.81
19801	8.3		15009	4.2	0.40	6.10	60.4	170	90	23.5		69.0	.08	502550	315.0	276	4.28	3.8	99	17	59.9	38.03	10.77	21.50
17751	11.4		13479	4.2	0.69	7.30	69.0	245	89	33.0	13.5	44.0	0.56	532440	359.0	460	3.3	3.5	108	4	58.0	41.09	10.88	21.41
18469	11.4		13981	4.4	0.42	6.48	64.0	237	88	44.0		149.0	1.1	481690	983.0	895	3.4	2.9	103	10	59.0	38.26	11.48	22.90
21874	8.4		14083	3.9	0.33	6.27	60.0	276	88	44.0	14.0	158.0	.7	487080	788.0	595	3.4	3.2	108	14	59.0	41.94	11.05	23.10
23508	8.9		12994	3.7	0.32	5.80	58.0	308	85	33.0	14.0	82.0	.5	538800	536.0	596	5.8	4.6	99	3	59.0	44.26	11.50	23.00



Sprinkling filter, from top of digestion tank.

capacity of the dosing tank during the winter months, when the flow very often equals or exceeds the capacity of the plant (two million gallons). It was found, however, that better results were obtained even during the winter time when the filter was almost in continuous operation, with resting periods of a minute or less.

The sprinkling filter was constructed without a partition in the center so that when flooding was necessary in order to kill the psychoda (and we find that the only satisfactory method at our plant to control psychoda is by flooding), it was necessary to flood the entire filter, which took a day during the summer time to fill, a day flooded, and a day emptying. During the flooded period, the overflow indicated a B.O.D. of 35 p.p.m. as compared with the normal B.O.D. of from 15 to 20, and a B.O.D. of 60 during the emptying period.

In 1939 a partition was placed in the center of this filter so that only half of the filter is now flooded at one time while the other half is operating normally. The flooded filter is emptied very slowly so that it has very little effect on the effluent. It does, however, have some effect, even with the best of operation. Therefore, to overcome the undesirable feature, we installed a chemical precipitation plant between the sprinkling filter and the final settling tank. This unit consists of a small building, housing a dry-feed machine at the entrance of a mixing tank 60 feet long and 4½ feet deep. Baffles extending up from the bottom and others extending down from the top were placed in the mixing tank, the distances between sets being increased from the inlet to the outlet of the tank so that a wave action is caused, the waves being sharp at the inlet and gradually broadening out at the outlet. Alum is used as a coagulant and an excellent floc is obtained in the final settling tank. We have trouble with some of this floc passing over into the effluent but find that if we use an excessive amount of alum, this can be pretty well controlled.

This chemical plant is used not only after the filter has been flooded, but whenever the filter purges or releases suspended matter. We control this by frequent turbidity tests of the effluent and whenever the effluent exceeds a turbidity of 25, the plant is placed in operation. We find (as others have found) that there is a direct relation between the turbidity and the suspended solids and B.O.D. Inasmuch as the test for suspended solids and B.O.D. are somewhat complicated and take longer than turbidity tests which can be made in a few minutes, these afford an excellent means of control. A Jackson turbidimeter is used.

As a result of these alterations, it will be noted from the tabulation that the results for 1940 indicate the lowest average turbidity, 20.6 p.p.m. and the lowest B.O.D., 15.3 p.p.m. for the eight years the plant has been in operation. A recent test made by the New Jersey State Department of Health of all the plants on the Raritan river and its tributaries, indicated the B.O.D. of the effluent of the Princeton plant to be 12 p.p.m. at the time of the test, the lowest of some twenty tested. The tabulation indicates all data at the plant, including sewage flow, pumps in operation, power, information on the various tanks, sludge beds, chlorination, chemical and bacteriological data relative to the effluent and the river above and below the outfall. This tabulation does not show the B.O.D. of the river, but such analysis is made frequently along with bacteriological samples. The bacteriological samples, strange to say, almost always show that the river below is better than the river above. (See Tabulation). This does not hold true in the case of B.O.D., although there has been a steady improvement in the river.

Reduction in the Cost of Operation

Water obtained from the local Water Company has always been a large item of cost, totaling from $800 to $1,000 a year. In 1939 a dual water system was installed whereby the effluent is pumped from the final tank and used about the plant for flushing purposes and for supplying the chemical feeder and chlorine machine. There are no taps on the line which could be opened by hand although we feel that the effluent probably is as safe to drink as potable water. All taps must be opened by means of a wrench. This simple dual system has more than cut our water bills in half.

Another change which has greatly reduced the cost of operation was the purchase of chlorine in ton containers. Up to last year, chlorine was always purchased in 150-lb. containers. A platform was constructed outside and adjacent to the chlorine room onto which the ton containers are rolled from the truck. They are then stored 15 at a time on the platform, which is constructed of concrete, and used as needed. When needed, they are rolled from the platform on to a floor-truck and moved into the building. By the use of chlorine in this manner, we have saved approximately $1,000 a year. These savings resulted last year in the lowest cost of operation per million gallons—$20.45—of any of the eight previous years.

The cost for pumping will be noted as increasing slightly The total cost of treatment is divided as follows:

$0.75	for preliminary treatment.
1.25	for pre-chlorination.
.95	for filtering.
1.15	for chlorinating, post treatment.
1.80	for sludge treatment and disposal.
13.08	for administration and laboratory control.
1.47	for buildings, grounds, insurance.

These changes at the plant which have resulted in a better effluent at a lower cost, which every operator is striving for, were made by means of W.P.A. projects at a small initial cost to the municipality inasmuch as most of the cost was labor costs.

County Engineer Halbfass at his desk writing this article.

Spreading calcium chloride.

Results and Experiences with "Low Cost Roads" Construction Types

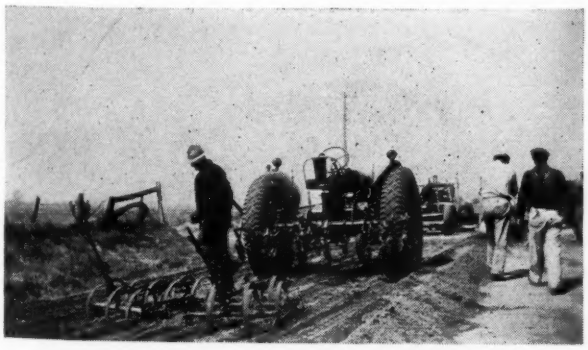
By F. P. G. HALBFASS
County Engineer, Muscatine Co., Iowa

THE month of November, 1940, marked the end of one year since we completed here, in Muscatine County, Iowa, the 16 miles of so called "low cost roads" in an effort to find more suitable types to meet traffic demands. My first descriptive paper on the project was written two months ago following completion of construction contracts, and appeared on page 13 of the November, 1939, issue of "PUBLIC WORKS."

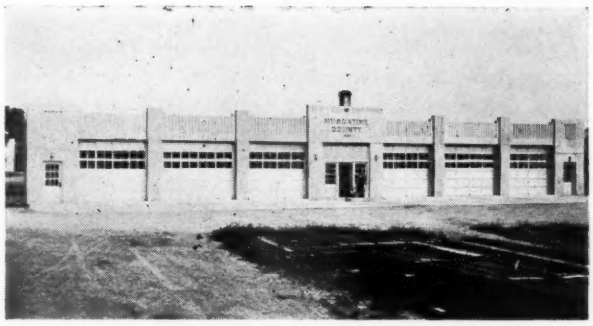
Results with "Type One" Surfaces

I will discuss the four sections of the "Type 1" surfaces in the order that they were constructed. This type consists of a bituminous black top on a stabilized base.

Section on County Trunk Road C.—This road extends to west from the Muscatine city limits along the foot of a bluff. The adjoining area has many springs. Previous to this work the section had been maintained as a gravel road for 25 years and unstable sub-grade conditions were attacked from year to year, using tile drains and stone and gravel filling, until it appeared to have reached a stable stage. The length is 2.69 miles and the area is 31,561 square yards.



Mixing by means of spring tooth harrow.



Muscatine County's shop, where all county equipment is taken for overhaul — also is headquarters for Superintendent of Equipment.

This section is the longest one of the four and carries the largest concentration of traffic, but yet there has not been a single base failure to date. However, the wearing surface has failed in four places, of which mention was made in my former report. This we attribute wholly to the fact that during original base construction we were unable to get the proper density and upon field examination we found it lacked proper mixing. We ordered the contractor to scarify, remix, relay and compact it. This he did, but in so doing he applied too much water and our field inspector permitted the prime to be applied too soon. The moisture content of the base at that time was exceptionally high.

During the early part of this year, we tried to correct this by numerous methods. We cut off the surface and tried to relay it, hoping that it would again bond to the base. This was of no avail. Therefore, in August of last year, we removed the wearing surface com-

Blading and shaping.

pletely, reprimed the base and rebuilt the bituminous mat complete with new materials. To date no creeping has shown up. The total amount removed was 2,048 square yards, against the total of 31,561 square yards within that project. Upon removal of the wearing course, as above mentioned, we found the base in excellent condition, but there was a film of moisture between the base and mat causing complete separation. The base was open to traffic for a period of approximately 30 days, during which time it acted as a wearing course and was subjected to the abrasive action of traffic with no detrimental results—not even becoming dusty.

The following results are of tests taken during the period of construction: The P.I. run from 3.0 to 7.4; the average dry weight density in pounds per cubic foot was 139.0, the maximum was 148.1, and the minimum was 135.4. The average taken was on ten tests distributed throughout the section. The road entered the winter season in good condition.

Section on County Trunk Road W.—This section extends Northwest from Muscatine city limits, through light, rolling agricultural country. This road had been maintained as a gravel road for 14 years and unstable grade conditions have been attacked over this period with tile drain construction, and with coarse pit-run gravel plugged in mud holes until the road became stable. The length is 2.22 miles and the area is 26,047 square yards.

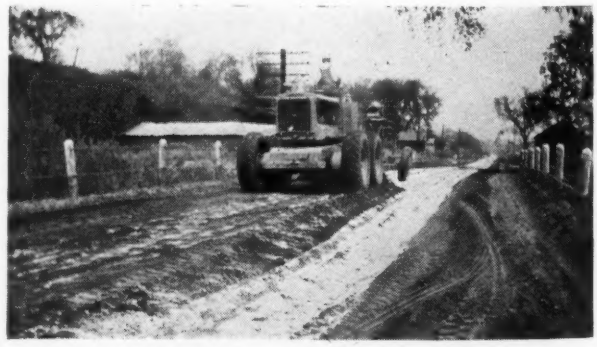
On this section there was a small area of about 89 square yards where the bituminous mat slipped, causing corrugations. This occurred shortly after construction was completed. By chance, we later learned that during construction the contractor accidentally dumped a tank of water at this spot. The base, however, did not fail. Therefore, we removed the bituminous surface, reprimed the base and surfaced it, using new materials. The balance of this section was in excellent condition until late fall of last year. In the early months of this year, two small areas showed signs of base failure. Upon removal of the surface, we found the base in a completely saturated condition and a film of free moisture immediately under the bituminous mat. Upon correction of the base failure, we resurfaced with the salvaged material, having first primed the base with prime similar to that which was used in the original construction, but this did not prove successful. The mat again failed to adhere to the base sufficiently to stand up under the traffic. Therefore, in our August program of repairing the mat surface, we removed the surfacing from all bases that had been patched before and wherever the mat showed signs of slipping, re-priming the base and replacing the surface with new material, using the original construction methods. On this section it had been necessary to widen the original road bed in place. The material used to make the fills was obtained from cleaning the ditches and cutting back slopes, and the material had quite a large clay content. Our base was constructed over this new fill in several instances and in every case the mat failed to adhere to the base causing it to corrugate along these narrow strips, while over the original road bed it would be bonded tight. It, therefore, appears that additional moisture contained in these shoulder widening fills affected the bond, and the base thickness over new fill should have been doubled. The total number of square yards replaced on this section amounted to 568 square yards. The P.I. on the original construction was from 5.3 to 10.0; the average dry weight density in pounds per cubic foot was 148.3, with a maximum of 180.3 and a minimum of 136.0. The road entered the winter season in good condition.

Section on County Trunk Road R.—This road extends to west of West Liberty, Iowa, through medium rolling agricultural and timber lands. This road had been maintained as a gravel road for 12 years. Much tiling had been done on the shoulder lines and down the slopes, in past years, and the surface had become fairly stable. It was decided to relocate and grade about a thousand feet on high ground, even though we thus lost the advantage of the old stable road surface for a sub-base over this length. The length of the section is 1.5 miles and the area 17,600 square yards.

On this section there were no apparent difficulties until early winter, when we discovered there were several places where base failures could be detected. Upon investigation, in two instances, it was found that the base was completely saturated, these being in a location that would indicate moisture reached the base through capillary attraction, hydrostatic pressure or a combination of both. On investigation of a third place, on the relocated section, we found that the saturated condition continued down at least 18 inches below our base. Therefore, we removed all of this saturated material and rebuilt the base from a solid foundation. These places, together with one other, we re-primed and resurfaced with completely new material during August. The area included in the repair of this section amounted to 201 square yards. The P.I. on this section averaged from 5.2 to 6.5; the average dry weight density in pounds per cubic foot was 142.7, with a maximum of 158.4 and a minimum of 136.0. The road went into winter in good condition.

Section on County Trunk Road S.—This extends to north, out of West Liberty, through rolling timber country and through a one-time pond, now drained with tile lines. The road had been maintained as a gravel road for eleven years and has remained in a

(Continued on page 38)

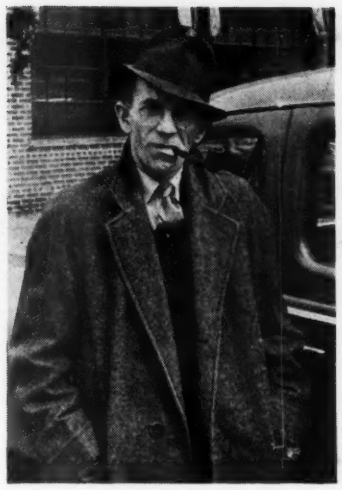


Motor grader on mixing job, after adding calcium chloride to base.

Designing and Building High School Bleachers

Bleachers 100 feet long with capacity for 600 people built as a WPA project for less than the estimated $11,680.

By CLYDE M. PRATT
Boro Engineer, Leonia, N. J.



Clyde M. Pratt.

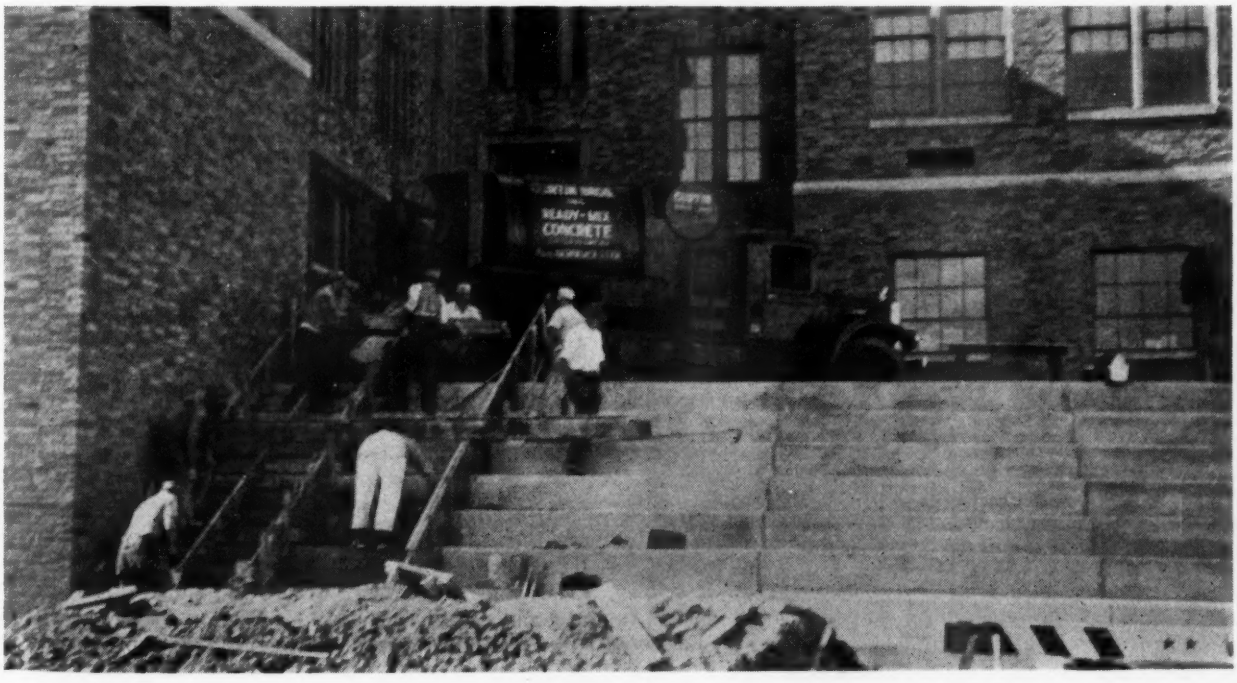
A SECTION of reinforced concrete bleachers for the athletic field at the high school has recently been completed by the Board of Education of Leonia, N. J., with the help of the WPA. Several years ago an addition was built on the westerly side of the school which left a ten-foot-high bank at the northwesterly ell of the building, the soil of which consisted mostly of sand, clay and miscellaneous rubble on which no self-respecting grass seed would grow; moreover, boys and girls of all ages love to run up and down banks. The Board was not inclined to appropriate funds for topsoil and planting to beautify the bank, but a year or so ago they voted to have a preliminary sketch drawn up and a cost estimate for the construction of concrete bleacher seats here, which would serve the double purpose of beautification and usefulness.

Accordingly, upon petition to the Mayor and Council, my services were loaned to the Board of Education to design and estimate the project for the February Board Election, it being necessary to have the project and funds approved by referendum. A preliminary sketch of the bleachers was drawn up and a number of white prints made to display at the local stores. The project was estimated to cost about $11,680, of which approximately $2,000 would cover the cost of materials and would represent the sponsor's share, and the balance would represent the Federal contribution for WPA labor.

The project was discussed pro and con by the citizens, some objecting that the bleachers could not be built for the sum requested, others that the project would be a waste of the taxpayers' money since the bleachers would only be used for a few months in the fall during football season. However, a large majority of the votes were cast in favor of the issue.

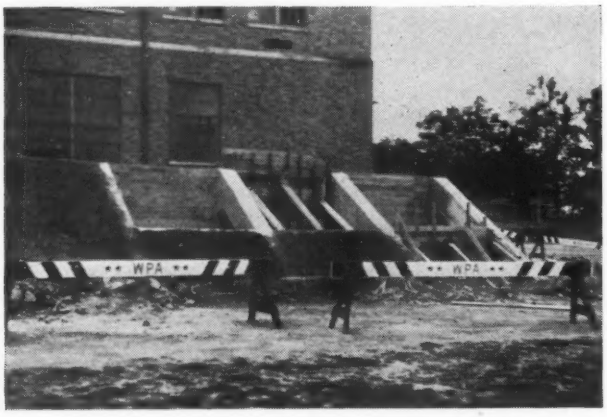
Accordingly, plans were prepared, the WPA Project drawn up and submitted for approval, and by the end of June actual construction was under way. In spite of some bad weather throughout the summer, necessitating layoffs, the bleachers proper were completed by the latter part of September, in time for the first football game of the season. Needless to say they were packed with enthusiastic rooters.

The bleachers, estimated to hold about 600 people, are 100 feet long, 10 feet high above grade and 16 feet in depth. The treads of the seats are 2 feet wide



Pouring entrance steps at left end of bleachers.

Second bay of seats poured and the mat of reinforcing steel in readiness.



Front elevation illustrating storage room construction.

End elevation showing storage room. Note ramp at right.

Close-up of buttress wall, showing storage room door.

and the rise is 14 inches. There are entrance steps at each end and a 2-inch double pipe railing along the right and the rear sides. The sidewalk was rebuilt from the left rear of the bleachers to the fire exit steps from the High School Building. This sidewalk also has a guard railing. Underneath the right end of the bleachers is a storage room 38 feet long, 8 feet wide and averaging 7 feet high. This room, which can be used to store the wooden bleacher seats between seasons and also the lawn mowing equipment during the winter months, has a 4 x 5-foot door in the far right or buttress wall and a 6-light wire glass window in the rear.

The author, prior to the actual designing of the bleachers, made several inspection trips to neighboring athletic fields and thereby profited from the mistakes of others by considering more seriously the expansion and contraction of concrete. Large irregular cracks were noticeable in other bleachers and every precaution was taken to prevent them in this project.

The actual design was kept as simple as possible. The entire length of the bleachers is divided into ten bays of 10 feet, and each treated as a separate reinforced concrete slab with the seats constructed as an integral part. Ample factor of safety was provided by using a live load of 200 pounds per square foot in the design. Longitudinal dowels across all joints between slabs prevent raised sections. Each slab is 7 inches thick, reinforced longitudinally by ½-inch deformed bars spaced 2 feet on centers, and laterally by ½-inch bars spaced 18 inches on centers. Although six of these slabs are resting on a 6-inch bed of well-rammed steam cinders placed on the old bank, the reinforcing was used to prevent cracking due to frost action as well as to provide additional strength.

Footings for the 12-inch thick foundation walls are 12 inches deep and 30 inches wide and are placed on a 6-inch bed of well-rammed steam cinders. Only the footings under the foundation walls of the storage room and under the buttress wall are reinforced, two ¾-inch rods 12 feet long being placed on 10-inch centers in each.

The three foundation walls in the storage room were widened to 16 inches and reinforced by an arch of three ¾-inch bars 20 feet long spaced 4 inches on centers. The buttress wall over the doorway was reinforced by two ¾-in rods spaced 4 inches on centers. The face wall of the lowest seat is designed as a simple beam 9 feet in span between faces of the footings and is reinforced by two sets of two ½-inch rods spaced 4 inches on centers horizontally and 2 feet on centers vertically.

Actual construction proceeded normally, two sets of foundation panel forms to exact measurements were built and while one form was in the process of being poured the other was being erected. Dowel bars ½-inch in diameter and 12 inches long were spaced 2 feet on centers on each side of the center line of the top sides of the foundation walls to act as ties for the slabs.

The front and rear walls of the storage room are 6 inches thick and vary in height above the footings from 4 feet in front to 11 feet in the rear. Both were reinforced with ½-inch bars spaced 2 feet vertically and horizontally. The storage room floor is concrete 6 inches thick. As soon as the forms for the various walls and the under sides of the slabs over the storage room had been stripped, the surfaces were given a coat of neat cement plaster for waterproofing purposes.

The integral slabs and seats were poured in bays,

View of completed bleachers.

and the forms were stripped twelve hours later in order to facilitate finishing. A lateral expansion joint was provided by nailing ½-inch asphalt sheets at the end of each bay over the center line of each foundation wall. Standards for the 2-inch double pipe railing were set into previously formed holes in the steps 10 inches deep. The entire railing was given two coats of aluminum paint.

Ready-mix concrete was used throughout the job, 162 cubic yards being used in all. Specifications for the concrete are as follows:

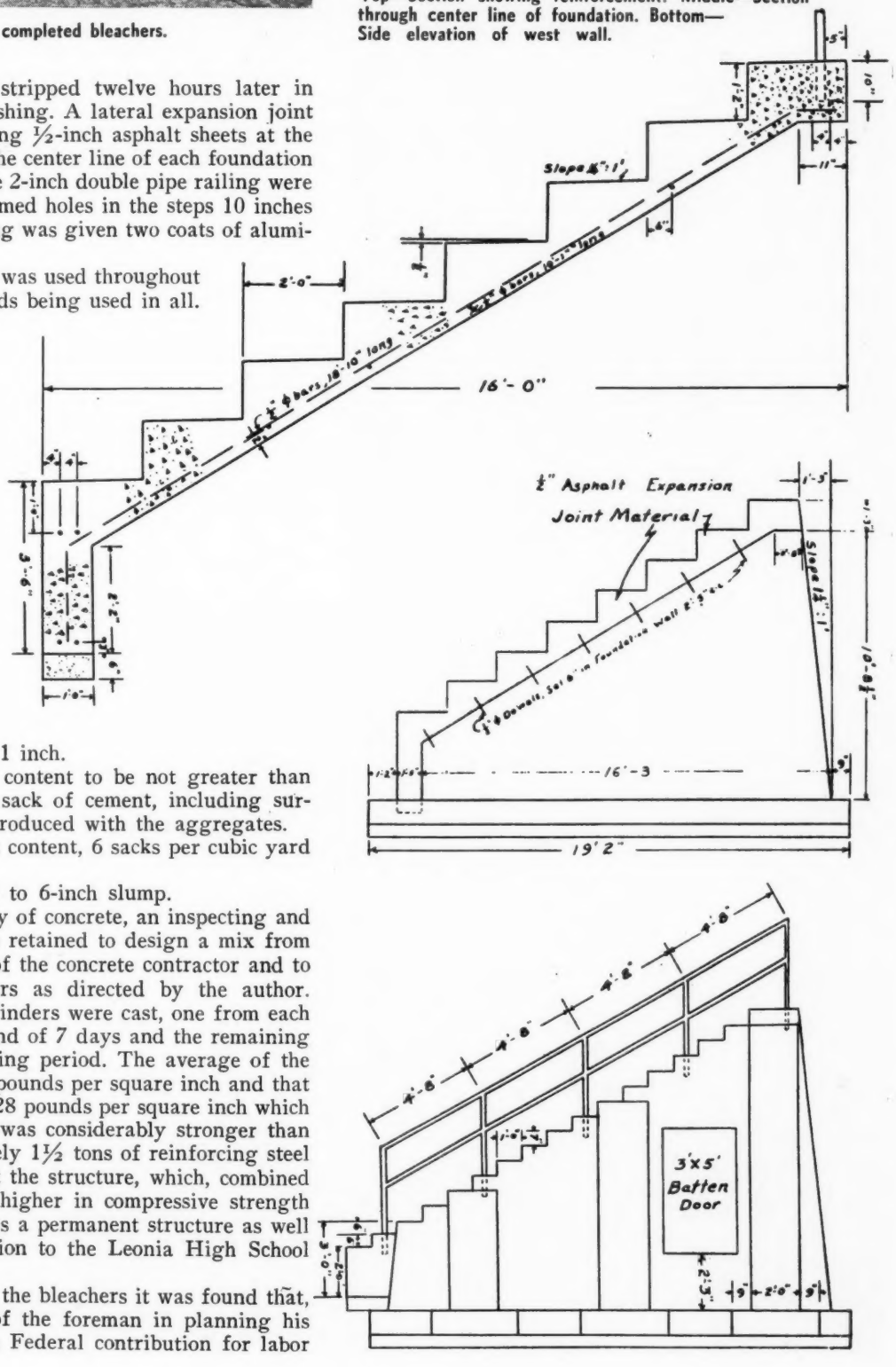
1. Compressive strength at 28 days, 3,000 pounds per square inch.
2. Coarse aggregate to be in accordance with the New Jersey State Highway Specifications for ¾-inch aggregate, maximum size to be not greater than 1 inch.
3. Maximum water content to be not greater than 6½ gallons per sack of cement, including surface moisture introduced with the aggregates.
4. Minimum cement content, 6 sacks per cubic yard of concrete.
5. Consistency of 4 to 6-inch slump.

To insure uniformity of concrete, an inspecting and testing laboratory was retained to design a mix from the specific materials of the concrete contractor and to cast specimen cylinders as directed by the author. Three sets of three cylinders were cast, one from each set was tested at the end of 7 days and the remaining two at the 28-day curing period. The average of the 7-day tests was 2,582 pounds per square inch and that of the 28-day tests 4,128 pounds per square inch which indicates the concrete was considerably stronger than specified. Approximately 1½ tons of reinforcing steel was placed throughout the structure, which, combined with a concrete 37% higher in compressive strength than required, indicates a permanent structure as well as an attractive addition to the Leonia High School Athletic Field.

Upon completion of the bleachers it was found that, due to the efficiency of the foreman in planning his work, an excess in the Federal contribution for labor existed. Application was made to the WPA for permission to use these funds for additional work which would aid in beautifying the area at the rear of the bleachers. There also existed, due to close supervision in purchasing materials for the original project, a sufficient sum of money in the Board of Education's contribution to defray the expense of this additional work.

The additional work included erection of a hand railing of 1¼-inch pipe; rebuilding concrete steps from the fire exit platform to the sidewalk leading from the building to the bleachers; and several other small jobs.

Top—Section showing reinforcement. Middle—Section through center line of foundation. Bottom—Side elevation of west wall.



An Attractive Water Purification Plant At Lansing, Mich.

Continuing our series illustrating some modern and attractive water and sewage plant buildings

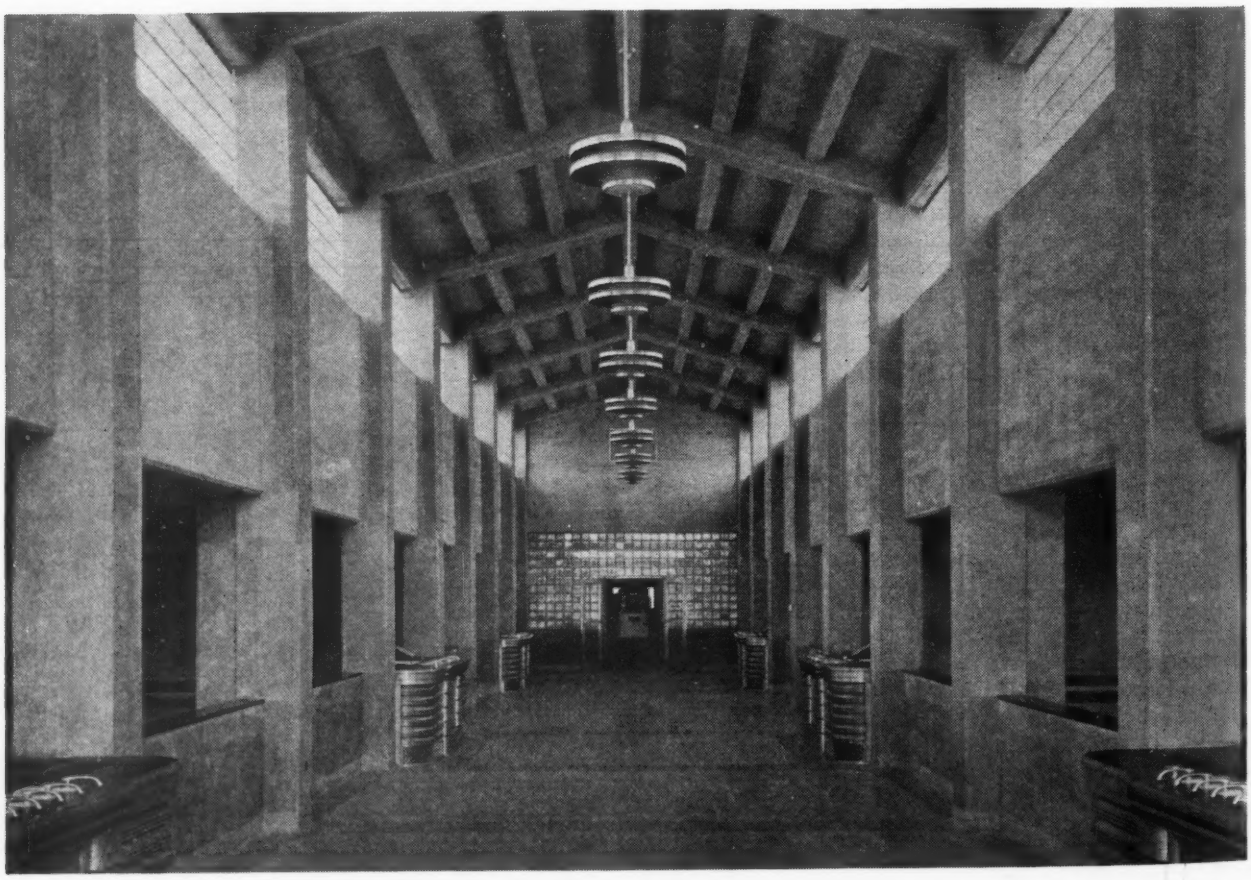
This plant erected at Lansing is for complete treatment of 70 million gallons a day.

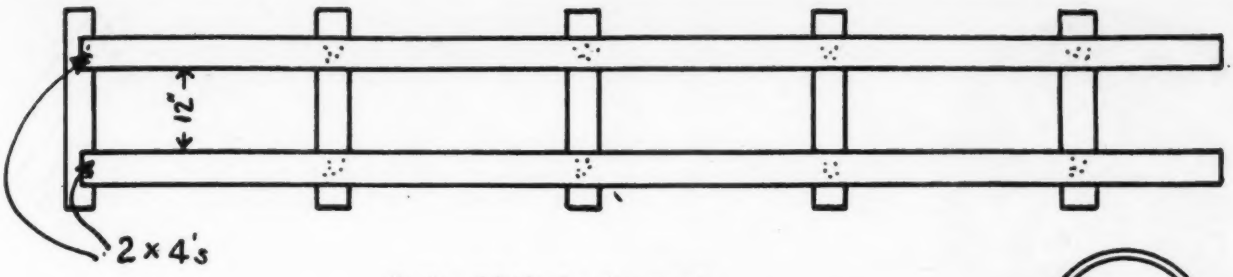
Otto E. Eckert, General Manager, Board of Water, Electric and Light Commissioners.

Architects, Lee Black and Kenneth C. Black.

Engineers, Alvord, Burdick & Howson.

Built by W.P.A.





Section of ladder for pipe support.

Laying a Pipe Up a 45° Slope

End view of pipe on ladder.

By B. C. GOSNEY
Water Superintendent, Auburn, Washington

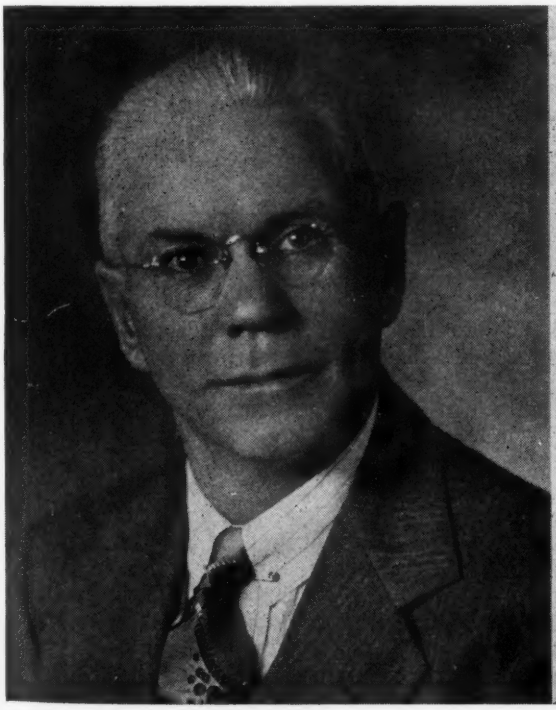
LAST summer this city had to replace an old 16-inch pipe which led from a 3-million-gallon reservoir down a very steep hill and connected with the distribution system. Two problems were presented: One to supply the city with water while the line was being replaced, and the other to lay the pipe line properly on a 45° slope of loose gravel.

There already existed a 14-inch line from the pump house to the reservoir, and by use of this we were able to solve the first problem. We first installed, at the foot of the hill, a bypass or connection between the 14-inch line and the old 16-inch distribution system main. Then we removed the flapper from a check valve in the 14-inch line near the reservoir, so that when the city required more water than the pumps produced, the reservoir could supply it; and when the consumption was less, it would receive the surplus.

The hill was all loose gravel, with a slope of about 45°. The men could scarcely stand up on it, and we placed board walls about 6 feet high at intervals of 40 feet to enable the men to stand and to protect them from rolling rocks while excavating and removing the old pipe line.

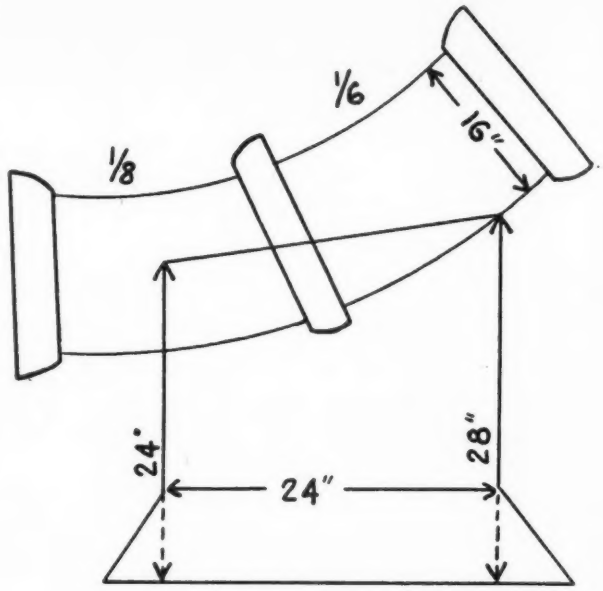
Our next problem was to get a true grade for the cast iron pipe (which weighed 105 pounds per foot). We subgraded as best we could on account of slides and cave-ins to a near grade. We then made a ladder of 2 x 4's, spacing the sides about 12 inches apart so that the contour of the pipe would ride the 2 x 4's and not strike the cross ties, which were about 6 ft. apart.

This ladder was made in sections 16 ft. long. Beginning at the foot of the hill we placed each section of the ladder to a true grade till we reached the top of the hill, about 200 ft. in all. The pipe was then delivered to the brow of the hill, and each length of pipe was lowered by a small gasoline hoist, the pipe



B. C. Gosney.

View of completed pipe line.



Concrete base for pipe at foot of slope.

sliding in the ladder until it reached the preceding length. The pipe was in 6 ft. lengths with a machined and bolted joint. It would have been very difficult to use any other type of joint on this job as the ladder made it impossible to yarn or calk a joint, and also the hazard of handling molten metal on the steep and loose gravel hillside was too great.

After the line was completed there were no variations in the grade, as the ladder had been staked so that it could not move. At the foot of the hill we placed a concrete base 24" high and long and 36" wide to support the weight of the pipe; two ⅛ bends being set in the concrete so there can be no movement in the pipe line. No leaks have developed in this line to date.

It may also be interesting to some of your readers to know that this city uses hydraulic rams for pumping water. So far as I know we are the only city of this size (population 4,200) or larger that uses the hydraulic ram. We are said to have the largest battery of rams in the world. This consists of five 12-inch rams pumping 200 gallons each per minute, with an adequate electric pump in reserve in case of injury to rams or if more water is required than the rams will lift.

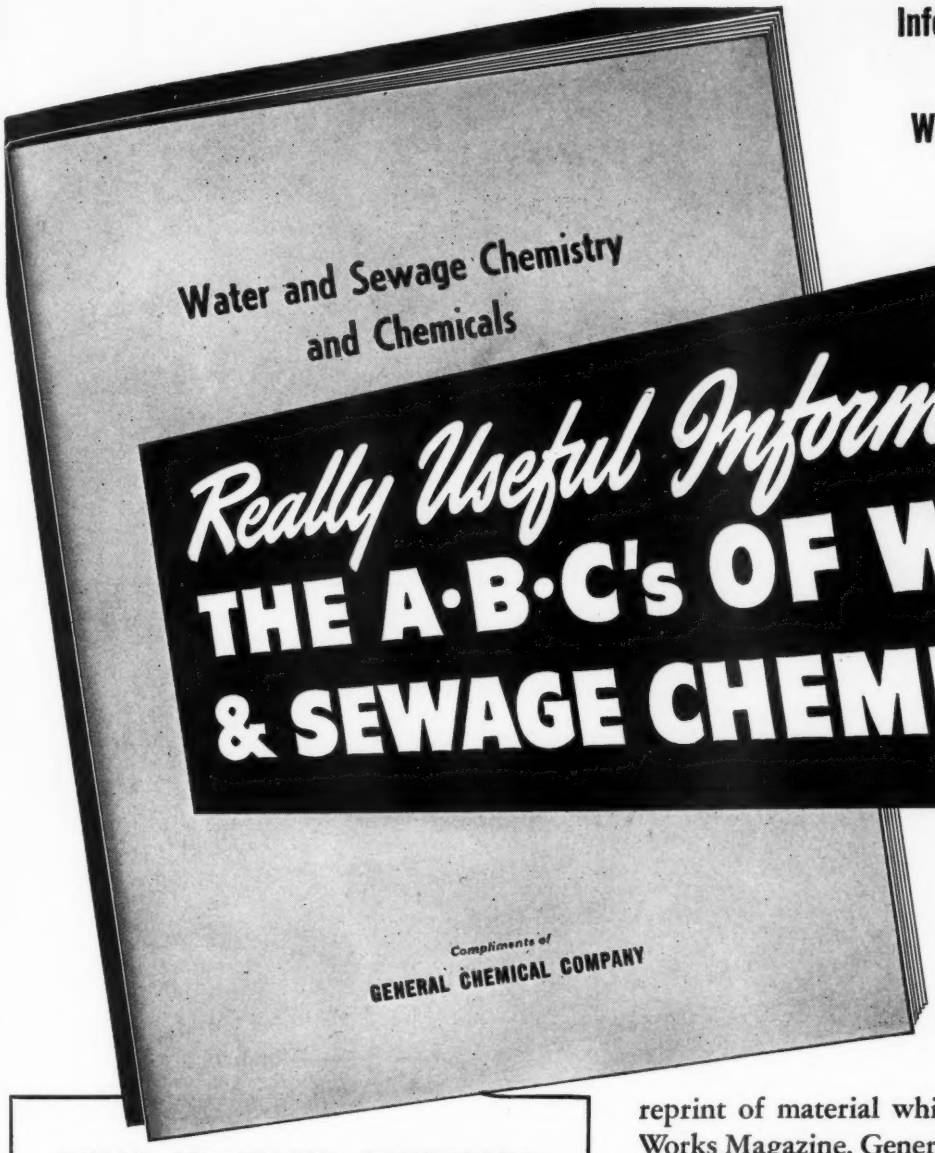
Another Penalty for Diversion of Highway Funds

Reports from Washington indicate it is virtually certain that another federal penalty will be imposed upon Georgia for diversions of highway funds which occurred in that state between July 1, 1940, and June 30, 1941.

Georgia lost $504,074, or approximately 16 per cent of its federal highway allocation of $3,360,507 during the last year for failure to use the proceeds of its gasoline tax and motor vehicle registration fees for highway purposes.

If another penalty is imposed, Washington reports indicate that it may be double the amount of the initial penalty. Under the federal highway law a state may be penalized by loss of as much as 33 1/3 per cent of its federal aid if it diverts highway money away from the roads.

Information for Every Operator—
Compiled by
Water and Sewage Authorities



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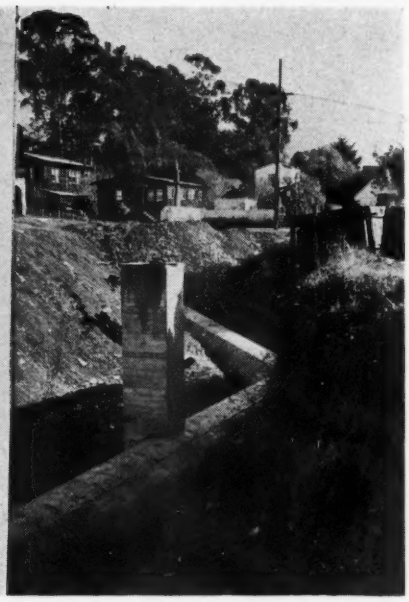
Effect of a sudden rain storm.

Stage two. Note storm water.



Looking east, completed job.

Building a Storm Drain at Albany, Calif.

By H. I. DYGERT
City Engineer, Albany, Calif.

ALONG the southern boundary of the city of Albany, Calif., runs a creek known as Cordinices creek. Houses on the south bank of this old waterway were built close to it. Erosion along this bank was threatening to undermine these houses, and last year the owners petitioned the city council to do something to prevent it. The council tossed the matter into the Engineering Department's lap, and as it appeared that everyone would be benefited we decided that an easement would be required. This was plenty easy to obtain.

After making a survey in September we decided to construct a concrete culvert, with flat bottom and arched top, 6 ft. wide by 6 ft. high and 227 ft. long, building it in two stages or sections.

Sloppy digging, done by hand; stage one.

Looking west at finished stage one.

We began excavating for the culvert by means of a bulldozer, but this got stuck, so the big cutting was finished with a small horse-drawn Fresno scraper. Most of the excavation, however, was done by hand with WPA assistance. It was very sloppy work at times, but we trimmed it by hand the full length and almost got stage 1 in before the first rain.

The forms were so designed that they could be removed and used again, except that for the angle in the sewer line, which was worked out so that there was very little hand fitting. A manhole was provided near the angle point. As there was an empty lot on the north bank and this was high, we poured the concrete from there, using as a flume an 8″ pipe telescoping into a 10″, making it possible to discharge the concrete 45 ft. each way from the mixer.

The culvert was reinforced throughout with half-

inch steel, bent to shape as received. The cement ran 5½ sacks to the yard in place. An electric vibrator was rented at a cost of $37.50 for the job and was used very thoroughly, producing as good a finished job as can be found anywhere. The total cost was $1,797.50, or about $7.92 per running foot.

Shortly after this project was started I went on my vacation, and Jack O'Leary, my assistant superintendent of streets, was left in charge. Due to his excellent control of the work, things were going so smoothly when I got back that I only watched the finish of the job as a bystander. The job was completed by December 1st.

Extra Work on Sewer Construction Contract

In an action on a city contract for the construction of sewers in connection with a grade elimination project, to recover for extra work, the New York Appellate Division held (Remo Engineering Corp. v. City of New York, 23 N.Y.S. 2d 314) that the city was not liable to the contractor for damages not shown to have sufficient causal relation to the breach of contract claimed to justify an allowance. But the contractor was held entitled to compensation for extra work caused by the elimination of a drain called for by a contract of a third party in contemplation of which the plaintiff's contract was made. The plaintiff was also held to have established prima facie a claim for the assessment of damages, if any, caused by the fact that the city, contrary to the terms of the contract, compelled the contractor to tunnel under a field house, rather than to proceed by open cut. The judgment for plaintiff of Trial Term, Bronx County (11 N.Y.S. 2d 590) was affirmed in accordance with this opinion.

Softening St. Paul's Water Receives Public Approval

On January 6, 1940, the Water Department of St. Paul, Minn., started softening the city water. The softening plant has operated continuously since. Aside from the normal adjustments and trial periods which must be expected in starting such a plant with the large amount of miscellaneous and control equipment, the entire operation and results have been very satisfactory. Each month has seen the operation smoothed out, and constant study of results by the chemists has resulted in a water far superior to the old in every respect. The color of the water has been reduced from an average of 14.7 to 8.0. Total hardness from an average of 174 to 85 and the pH maintained at 7.5 or essentially the same as the unsoftened water, so that the average consumer is not able to detect any change in taste.

It is also very gratifying to note the general public's response to water softening. Complaints were very few and of short duration, commendations were many. It is difficult to evaluate the total benefits of this service to the consumer, but the reduction in the hardness is equivalent to the saving of 4,400 pounds of pure soap per million gallons. If but 2 percent of all the water used required soap, the total saving in soap for the city during the year was $206,534.00. The total additional operation costs of water softening, including fixed charges, amounted to approximately $54,000.00, so the net savings to water users during the year was over $152,000.00.

The above is from the report of Leonard N. Thompson, general superintendent of the department, for the year 1940.

Obsolescence of Water Plant Equipment

By EDW. S. HOPKINS

Bureau of Water Supply, Baltimore, Md.

IT IS recognized that all plant supervisors are desirous of obtaining new and good equipment. The beauty of new equipment, together with the implied thought that the person in charge is abreast of his work by procuring it, are often factors underlying its purchase. It is quite true that the expected increase in efficiency of the new apparatus when compared with that in use, is the major consideration for the expenditure of funds for this purpose. New equipment may often be acquired as the result of salesmanship rather than by a careful evaluation of existing operating costs. It is the same spirit that causes one to trade in a perfectly good and dependable automobile, that has traveled only 30,000 miles, because it is not as streamlined or as pleasing in appearance as the newer models.

Materials used in plant operation are called "consumer goods." This is a term used by accountants for materials that are expended in the process of operation. It is obvious that this term includes coagulating chemicals, but it also includes such things as laboratory apparatus, coal, window glass, electric current, wash water, etc. The replacement of these materials is a necessary charge against operation costs. Machinery such as elevators, feeders, conveyors, chlorinators, etc., are known as "producer goods" and also as "fixed equipment." The justification for the purchase of new fixed equipment is the ability of the machinery to decrease the use of consumer goods. In short, the new installation must be more efficient than the old to justify the money invested in it.

The term "amortization" is used when evaluating water plant and water works equipment. This term may be defined as the investment cost spread over a stated period of years, plus the interest charges on the investment for that period. A given time period is empirically chosen, which is assumed to be the expected usable life of the plant or appurtenances.

Heavy machinery such as conveyors, elevators, cranes, etc., is usually amortized on a 5 percent basis; that is, the cost will be spread over a 20-year period. Other devices such as feeders, chlorinators, loss of head or rate of flow gages, are given much shorter periods, usually 10 years. Control apparatus is frequently considered worn out in 5 years, or amortized on a 20 percent basis. These values do not necessarily mean that the equipment will go to pieces within the time of amortization. As a matter of fact, the actual usable life is greatly in excess of the amortization period.

Operating appliances are amortized upon a shorter time period than that for heavy machinery because new models having increased efficiency are manufactured at stated periods and brought on the market. It does not pay the manufacturer after a reasonable period of years to continue producing parts for old equipment. To do so would require continuing a line of special tools in his establishment and large surpluses in the stock room. For this reason, after a period of years it is no longer possible to obtain replacement parts of the old machinery. When this situation has been reached, the machine is obsolete, should be scrapped, and new purchased. In many plants machinery has been continuously repaired until it has become so old that this condition exists.

The desire for new equipment having improved devices frequently overcomes the natural urge for economy, and in some instances serviceable appliances are scrapped so as to obtain a new piece of machinery that may be more efficient. In many instances the efficiency of the new machine is of such magnitude as to pay its way and it thus justifies the scrapping of the old, even though it has not reached the stage of obsolesence described in the preceding paragraph.

Some years ago a visit was made to one of the newer water purification plants in the United States. Their dry feeders were all enclosed; there were dust proof doors on all chutes; automatic elevators; signal lights and equipment; filter operating table valves were electrically driven; and gages of all sorts and descriptions were installed. Upon returning home and making the usual morning inspection, the home plant, built some 25 years ago, resembled a factory, creating a feeling of distaste for its crudities. One should not be confused by such a comparison. If the plant machinery is functioning and operating efficiently, it is just as good as the newest equipment invented, and one must not allow pride or the desire to possess nice apparatus overcome good judgment as to the efficiency of existing devices. There is often such a tendency.

Water plants are in operation in which the rate of flow and loss of head gages are no longer functioning, and Venturi meters have been allowed to fall into disrepair from disuse. Such conditions should be remedied by prompt repair or by new installations, but the absence of control lights or automatic gadgets is not a sound reason for seeking to purchase new equipment.

After a machine has been in service for a long period of time and repairs have become costly, a bit of contempt slowly forms in the operator's mind toward that equipment. In a short time the attitude is assumed that it is not worth trying to keep in shape, and it is, therefore, considered worn out and ready for the junk heap. Very frequently this lax attitude toward repair and replacement scraps an otherwise good machine. This attitude to acquire new apparatus at what might be called the expense of the old, is frequently noted. "Why should I bother with it when we can get something new and better" is often heard. There should never be laxity in replacement and repair to machinery, regardless of how efficient it may be without overhauling, provided that when properly repaired or needed parts replaced, this efficiency is equal to that of a more modern machine.

It is very seldom that a pump wears out in a water plant. Pumps amortized over a 20-year period are frequently replaced at an earlier date due to increased service demands, and the storeroom probably has a collection of such items. This replacement is justified

since the demands of the service created the need for the replacement. The same applies to motors.

It is apparent to all that replacement of equipment on the basis of efficiency is desirable. As new machinery is produced, older appliances become more and more wasteful, and the time is finally reached when the old apparatus may be functioning accurately, but the waste in consumer goods justifies the investment in new devices. By the continuous improvement in pump design, operating conditions now reach 90 per cent, whereas 10 or 15 years ago 60 to 65 per cent was considered excellent. This 30 per cent differential justifies the purchase of new equipment, since the electric input will be greatly decreased for an equal volume of water pumped, when compared with that required by the older pump in service. It is obvious, therefore, that equipment is frequently replaced when it has become inefficient in terms of operating cost before it is actually worn out in the sense of being thrown on the scrap heap.

When utilizing the relative efficiency of equipment as a basis of consideration for the purchase of new, a careful survey should be made of the operating costs over the previous 5-year period. In addition to such a survey, the cost of replacement of various parts of the unit, and the relative probable life of the rehabilitated machine in terms of 'amortization' should be considered. Too frequently a machine is scrapped because last year's performance has been unsatisfactory without any thought as to the possible restoration of efficiency, or consideration of its operating cost over a reasonable period of years.

In most of the larger plants a complete machine shop is maintained for the purpose of making all minor and possibly a large portion of the major repairs to plant equipment. In many small plants minor repairs are made by the operator, and it may be argued that his time should not be charged against this work since he is there anyway. As a matter of fact this is a good argument, but if strict accounting is to be kept as to the cost of operation, the proportion of time put on repair should be charged to it, so that an accurate determination of the efficiency and life of a given machine may be made.

Insofar as possible, equipment produced by standard manufacturers should be used. It is recognized that a skilled mechanic can replace and improvise parts that are just as good as those put out by the manufacturer, but if a careful time record is kept, it is believed the cost of making this replacement part is greater than if it were bought from the manufacturer of the original machine. Home made parts should only be utilized in an emergency, and such practice should not be encouraged. The fallacy of this lies in the fact that reliance is placed upon an individual capable of making these parts, with a resultant tendency toward a one-man set up, rather than reliance upon auxiliary parts in the store room easily renewed by anyone on duty when breaks occur.

Frequent testing of all types of machinery should be practiced. Pump efficiency should be tested at least yearly. Operating equipment, such as loss of head gages, rate of flow controllers, recording devices on chemical controllers, should be checked monthly. Other types of equipment should be checked whenever it is apparent that they are wearing and may have lost efficiency. Only by frequent testing of equipment will efficient operation be continuously maintained.

This material was presented as a paper by Mr. Hopkins before the 15th meeting of the Maryland-Delaware Water and Sewerage Association, May 8-9, 1941, Washington, D. C.

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Bypass Highways

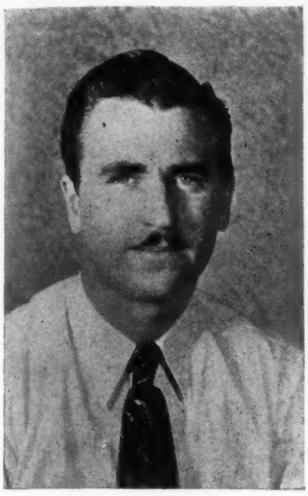
(Continued from page 12)

to the individual city will be infinitesimal. This may be true to a certain extent but on the other hand, every vehicle removed from a congested street system where left turns and cross traffic cause serious tie-ups at each intersection, will aid in relieving the traffic problem; and in the smaller towns where the proportion of through traffic to local traffic is nearly equal, the favorable effect would be pronounced. Therefore, bypass construction deserves careful and immediate consideration in hundreds of towns and cities throughout the nation.

There is, and has been, violent opposition by merchants and businessmen in many communities to the construction of those highway facilities that have as an object the diversion of a single vehicle from Main Street, and however erroneous these opinions may be considered by traffic experts, the fact remains that business groups have successfully blocked the construction of bypasses in many instances and in fact have established State policies against their construction. It is believed, however, that if the true facts relative to business derived from through traffic were properly presented and if the bypass was consciously designed to meet and overcome business diversion, the opposition could be turned into active support. A traffic investigation of through vehicles establishing the number of cars out of every thousand which stopped and made purchases, the average value of each purchase, and the fact that the business received from this class of trade was not commensurate with the congestion and occupation of street space occasioned by the through traffic, would indicate to businessmen that they were losing a more lucrative trade from local patrons who were being forced off the streets by the congestion caused by foreign traffic. Coupled with these statistics if the proposition was made to so construct the bypass that all that portion of the through traffic desiring to do business or obtain food and refreshment would be encouraged to enter the town, and if the development of new business competitors were prevented from springing up along the new route, thus safeguarding the present locations of business establishments and reducing the possibility of stagnation, the opposition of local merchants could be converted into support. The presentation of pertinent facts and candid, open, and frank discussion by public officials with businessmen, civic bodies, motor clubs, and chambers of commerce, would do much to clear the air and dispel the suspicion that someone was endeavoring to "railroad" through a proposition which would spell business ruin for the town. The slogan for a bypass route might well be "Every Car a Customer," which signifies that the town would be rid of the thousands of through cars each day which would not, under any circumstances, stop and make a purchase but nevertheless occupy valuable street space and cause a congestion that discourages the legitimate customer who might wish to enter the town to shop. Each through motorist that turned off the bypass and entered the town would be a live customer. "Every Car a Customer" is a slogan which will appeal to businessmen.

There is a certain amount of truth in the contention by merchants in smaller communities that bypasses will hurt their businesses inasmuch as they can point to instances where bypasses have hurt those merchants doing certain types of business who have establishments fronting on the old route. In addition, the di-

(Continued on page 35)



James M. Loth.

How We Operated County-Owned Equipment on WPA Projects

By JAMES M. LOTH
Engineer of Crawford County, Kansas

Equipment was purchased sufficient to keep 1,500 men at work on fifteen road projects. Close cooperation between County and WPA in arranging a working schedule secured efficiency and economy.

CRAWFORD COUNTY, Kansas, has a population of approximately 46,000 people, and at the present time 4,600 families are certified and eligible for some phase of relief. Of this number, 3,000 are able bodied persons eligible for WPA project assignments. To provide employment for these, giving them an opportunity to make an income that will approximate that necessary for supplying their needs and at the same time provide better conditions for local business, WPA projects offers a better medium than any other type of relief. They also give the community and taxpayers something in return for the money spent, while it does not cost the county directly any more than other types of relief projects which are more or less a dole.

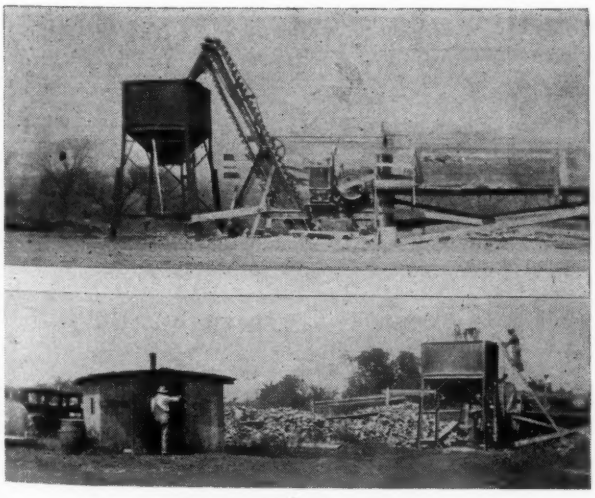
Under these conditions, and desiring to obtain the most valuable return for the money it spent on relief, that is, 25% of the total cost of the projects, Crawford County concluded that the best investment would be in road construction work that was really necessary. In order to perform such work in cooperation with Work Projects Administration, we have accumulated by purchase the following equipment:

Five 10-ton portable rock crushers (Rogers, Universal).

Three crawler-type tractors, 60 h.p. and up (Caterpillar, International).

Two 12-foot road graders (Adams).

Four 7S concrete mixers (Rex).



Two portable rock crushers.

International tractor and Adams leaning-wheel grader.

One 14S special equipped trailer-type concrete mixer for premixing bituminous surfacing materials (C.M.C.).

One 5-tooth rotary ripper (Killefer).

Two portable 110-cu. ft. air compressors (Ingersoll Rand, Sullivan).

One 6 cu. yd. four-wheel scraper (Le Tourneau).

One rebuilt 10-ton tandem roller.

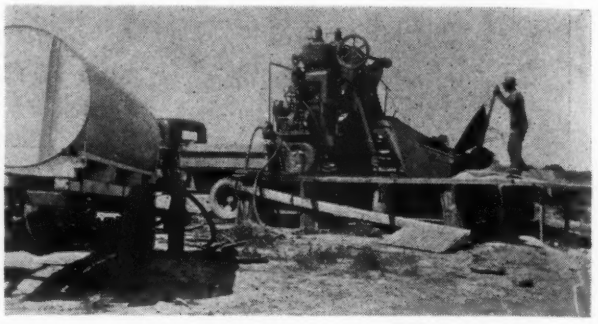
All of this equipment is used continually on approximately fifteen operating road projects, on which approximately 1,500 relief clients are employed to provide the necessary skilled, intermediate and common labor. The operating of this county-owned equipment absorbs not only all of the regular county employees but also all other operators available in the county.

The operation of this equipment, with operators' wages, fuel, maintenance of equipment, parts, repairs and other incidentals, together with the engineering and administrative costs; also cost of additional materials, team hire and rental of trucks and other equipment, all are included in the sponsor's contribution of 25%.

In carrying on this work it is our aim to provide employment for the maximum possible amount of labor while at the same time using a well-balanced, satisfactory method of construction procedure, justifiably efficient and within reason for a program of this nature. It must also be adjusted to the exact and limited monthly bond issue, in accordance with the cash basis law of Kansas.

These considerations make it necessary that the sponsor operate periodically on part time schedule, with a limited force of equipment operators assigned to WPA projects and working on a schedule of 24 days per calendar month. Such an arrangement demands a very close and cooperative connection be-

tween the sponsor's supervisor, his equipment operators, the WPA supervisory engineer and his foremen, whereby the work can be so outlined that, on the days when our equipment is not available, the WPA laborers can be used profitably on hand labor alone. There are many items of road construction on which a certain amount of hand labor is necessary or possible, and on days when only hand labor and small tools are available they are employed on work of this kind.



C. M. C. concrete mixer, tractor type.

Also, the sponsor regulates the working schedule so that its equipment and operators will not be assigned to this work on any of the days when the WPA workers are off; and it avoids working under inclement weather conditions. On these two points there is mutual understanding and management between the WPA supervisors and the sponsor. There were very few occasions when a project or construction item was handicapped due to a difference in working days between the sponsor and the WPA.

Difficulties of Publishing in London

The following letter will, we think probable, be interesting to our readers as it was to us, as a specific example of how the English are carrying on in spite of the difficulties imposed by war.

"Dear Sir: You may notice that I am making pretty liberal use of articles from your Journal and would ask you kindly to forgive me. The fact is that, owing to strict censorship, there is shortage of matter for publication in so far as home news is concerned and so we must go farther afield.

"Twice we have been bombed out of our offices and have lost most of our records and files in consequence.

"Feeling certain that you will agree to helping me over this difficult period I have anticipated your consent. Thanking you, I remain"

Yours very truly,
Hugh Miller, Editor,
"Highways and Bridges."

In the May 14th issue of "Highways and Bridges" appears the notice: "Owing to enemy action we are once again without office facilities, and for the time being our address will be c/o F. J. Parsons, Ltd., Lennox House, Norfolk Street, London, W.C.2."

Classification of Water Users

The Wisconsin Public Service Commission, In re Town of Pence, holds that classification of a municipal water utility"s customers within just and reasonable limits is proper and permissible, but to define a unit of service in such manner as to omit mention of stores, taverns, restaurants, offices and factories is unreasonably discriminatory.

version of traffic has, in some instances, resulted in creating blighted areas with resultant loss in tax revenues. These conditions have been brought about because the character and design of the bypass aided and abetted these unfortunate consequences.

In the past, with some notable exceptions, the bypass has been of normal rural or city street design, with all crossings at grade and unrestricted frontage. The new construction being more inviting because of its newness and due to the large volume of traffic passing over it daily, development takes place immediately, and business establishments spring up like mushrooms along the sides of the new highway. Because these establishments are new, clean, with modern fixtures, and inviting, no incentive is offered the traveling public to leave the new smooth riding highway, where parking facilities are plentiful, and enter the town, thereby risking the uncertainty of rough streets, congestion, and difficult parking, in order to transact business or obtain refreshment in an older establishment. Thus the new enterprises flourish to the detriment of the older businesses, rents are lowered, and tax revenues decline along the old route.

Because of the success of the new enterprises along the bypass, additional development takes place and in a few years the entire frontage is built up, parking becomes a problem, and the additional traffic generated on the cross streets creates intersectional delays. Soon the transportation effectiveness of the new facility is seriously crippled and the old problem of congestion and delay to the through traveler is as acute as ever. Main Street has simply been transferred from the old to the new location, and consideration must be given to new measures involving additional capital outlay. The process can conceivably continue decade after decade for an indefinite period.

This condition involves serious financial and economic loss to the traveling public, the taxpayer, and the community at large. The direct loss is sustained in the nullification of the sizable expenditure invested in the new facility and that suffered by the merchants and property owners along the old route. The bypass has become obsolete insofar as providing efficient transportation service. There is little wonder that opposition has arisen against this type of highway facility.

A new conception, therefore, is required in planning and designing bypass highways. Provision must be made to protect the new highway against mushroom growth along the borders and consideration must be given to safeguarding the interests of the established businesses in the community. These objectives are not incompatible, but a clearsighted long range policy and the courage to spend additional money today in order to safeguard the investment in the future is required. The project must be planned in order that improvements may be made with a modicum of loss in the previous investment in stages from time to time when traffic requirements warant. It is believed that such a plan is entirely feasible and practical of attainment in spite of lack of freeway legislation in most of the States, but it does require the support of city authorities and the acquisition of sufficient right of way to make it workable.

The plan consists of constructing the bypass at grade initially in order that construction costs may be kept to a minimum, but eliminating all cross roads

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except important ones by vacation; of purchasing right of way of sufficient width for parallel service streets and at the initially constructed crossings at grade, so that grade separations with connecting ramps may be constructed in the future if and when traffic requirements justify the cost; zoning the service streets against commercial development; physically separating the bypass from the service roads, thus preventing access at all points except at the grade intersections connecting important streets; and the prohibition of all frontage adjacent to the bypass itself. At the outset the ultimate final design should be developed on paper, based on grade separations at every cross street except streets permanently closed by vacation) complete with ramp connections thereto including the points where the new bypass leaves and rejoins the old route. When a satisfactory ultimate master plan has been developed, the actual plans for the initial phase of the construction can be drawn, utilizing such portions of the master plan as are justified by present traffic requirements and with an eye to the funds available. The basic elements which should not be skimped are the right-of-way, alignment and grades, for if any of these three elements are inadequate, the entire investment is jeopardized and the ultimate transportation effectiveness of the facility may be nullified. In most instances, where the improvement is over new right-of-way, it will not be necessary to grade or pave the parallel flanking local service streets, except where cross streets have been vacated, because this improvement can be undertaken by local assessments against the fronting property as development takes place.

The provision of service roads parallel and adjacent to the bypass to accommodate property frontage and vehicular access thereto insulates the bypass against mushroom development permanently and safeguards the investment and transportation efficiency of the new facility.

The connections and access roads which lead from the bypass to the business center are of primary interest to local businessmen, and this is particularly true of the old through-town route. These connections should be plainly visible and made attractive to the passing motorist, presenting a mute invitation to the traveler to turn into the town to obtain refreshment or shop. The intersection design should be of such character that traffic may depart and enter with ease and so that congestion will not develop. The design should be liberal with extra lanes where required, otherwise the merchants will feel they have been "short changed" and hostility will develop in place of desired support and cooperation. If the highway official responsible for the construction at all times clearly, fairly, and conscientiously, develops his plans to meet the interests of all affected parties, success will be assured. Much of the former opposition to bypasses, and of their failure to solve traffic problems satisfactorily, may be charged to disregard by officials of the livelihood of the citizen and a tendency to ride over him roughshod. The failure of many bypasses is the result of this shortsighted policy.

As a part of the project, adequate signs, electrically illuminated at night, should be constructed in strategic locations at the intersections that connect to direct access streets of suitable character leading to the business center of the town. The sign would advise the motorist the name of the town, point the direction to the business center, and state the availability of hotels, tourist homes, gasoline stations, restaurants, and free parking. In a word, an invitation should be issued to

the passing motorist to turn into the town and patronize the business establishments. The slogan "Every Car a Customer" would then have meaning.

It will be argued that it is not financially possible to acquire sufficient right of way to carry out the plan and, consequently, it is not practical. But, if the location is carefully selected sufficiently clear of built up areas and where assessed valuations are low, the property cost need not occupy too significant a portion of the total cost of the initial project. When it is considered that the life of right of way is, for all practical purposes, infinity if it is safeguarded against obsolescence by insulation and if the alignment and grades are adequate, the additional cost of the very element which safeguards the entire investment will be recognized as a very moderate and wise investment. Adequate right of way is the foundation of stage construction.

With a master plan of the ultimate completed project, sufficient right of way to carry it out, the new facility insulated against mushroom development and parking, the local businessman protected against competitors springing up along the new route, with inviting access to the town, the bypass highway will prove an enduring asset to the community as well as to automotive transportation. Only sufficient construction need be undertaken than is warranted by traffic requirements and funds available, but each improvement can be made in logical order according to plan and without sacrificing the previous investment. The project might quite logically start as a two-lane two-way highway, but in a predetermined position to form one roadway of an ultimately divided highway. As traffic develops, the next step might well be the provision of an additional two lane roadway and the formation of the medial divider. With continued traffic growth on the bypass and connecting highways, certain intersections may develop sufficient interference to justify, first, traffic signals and then grade separation structures with connecting ramps. This process would proceed step by step in logical sequence, each part fitting into the ultimate plan until all grade crossings had been eliminated. Thus the bypass would continue to increase in transportation efficiency from decade to decade without the necessity of scrapping substantial portions of the construction, thereby conserving the previous investment. This may be compared with past experience with ordinary bypasses where the transportation efficiency has been greatly reduced as traffic volume increases and unbridled development along the borders takes place, with consequent impairment of the investment and a general loss to the community and the motoring public.

It is, therefore, safe to state that the day of the bypass highway is not passed, but in order to secure an effective result, it is evident that a new type must be developed which will meet the problems of the present and the growing transportation requirements of the future.

Water Rates and Sewer Installation

A water company, Pleasant Green Water Company, applied to the Utah Public Service Commission for increased rates because a sewer project might be installed in the territory it served within the near future, which would lead to installation of modern plumbing and the additional use of water, with increased operating costs to the water company, and investment in additional equipment. The commission denied the application as seeking to base an increase in rates on a probability merely.

Results and Experiences with Low Cost Roads

(Continued from page 18)

fairly stable condition, with exception of one North sloping grade. The length is 1.28 miles, and the area 15,018 square yards.

This section, as a whole, gave us the least trouble of any of the four, there being but one small base failure, which upon investigation indicated that again water was reaching our base from the bottom, softening the same and causing the failure. This was repaired by rebuilding the base. We re-primed the base and re-surfaced it during the winter months. Yet, it has held and is in good condition at this time. It was not necessary to do any base repair or reconstruct any bituminous mat wearing surface during our August repair work.

The P.I. on this section seems to be about the same as County Trunk Road R; the average dry weight density in pounds per cubic foot was 138.2, with a maximum density of 148.5 and a minimum of 132.3.

Conclusions on Type "1"

The ½-inch per foot "A" crown is about right. A low P. I. is desirable for base construction. We would limit it to 6 or under, the idea being to use as little clay as possible but just sufficient for binder. A half pound of calcium chloride per square yard, per inch depth, is satisfactory for moisture control.

Sub-grade investigations should be made and undesirable soils removed, in particular where there are areas of recent cuts and fills.

If bases are constructed on areas of new grades they should be at least five or six inches thick. On old surfaced and stable grades a 3-inch thickness seems satisfactory. The need for thorough pulverizing of clay and thorough mixing of clay with aggregate cannot be over-emphasized. Base stability as a whole could be improved upon by thickening all edges to six inches.

These roads have just passed through a two months' period of alternate thawing and freezing and light rains and snows.

At many of the places where we had to widen the shoulders because of alignment defects in the old grades, we notice now that they have become slightly depressed and where this has recently occurred the wearing surface gets brittle and crumbles. The bituminous products we used in construction were MC 3 and MC 4 and it is our opinion that surfaces of SC might stand up better under slight movements of the base edges.

Bases before priming should be cured to permit, with certainty, a moisture content below 5% and should be checked by laboratory methods. Good penetration of the prime coat must be secured before applying the wearing surface and this cannot be accomplished without a thoroughly cured base. Earth shouldering and widening work should be completed ahead of priming.

Plans should be made to apply a surface seal coat within a year after construction. We are planning for a seal coat in 1941. Maintenance should be directed in both office and field by a trained individual.

Moisture content in a base can get out of control where bases are built to a high P.I. and calcium chloride used, but in a low P.I. base, the calcium

When you need special information—consult the *classified* READER'S SERVICE DEPT., pages 55-57

chloride gives the proper moisture control to give a dense and stable base.

In a low P.I.—calcium chloride base, the calcium chloride holds in the base the moisture content necessary for stability and surely tends to prevent expansion due to freezing of the moisture. Moisture films found under scattered areas of bituminous corrugated wearing surfaces may be due to the combination of calcium chloride with a too high base P.I., as on stretches where we know the P. I. is low we have had no corrugations.

Experiences with "Type 2"

Next I will discuss the two sections of the "Type 2" in the order that they were constructed. This type consists of a stabilized and compacted wearing crust built on a new well graded and rolled subgrade, surface treated with calcium chloride for a dust layer.

Section on County Trunk Road W.—This road is located in a good farming prairie country to the south from the town of Atalissa. The land is traversed with flat ditches and the deeper subgrades are underlaid with gravel. About 1½ miles extend into blow sand country.

The total length of this section is 6.6 miles; wearing crust width averages 23 feet; P.I. of the mixture is 8.

This is the section where we used salvaged material, limestone and lime dust, and the theoretical surface thickness, figured from weights, of 1 9/16 inches. This is also the section where we mixed in one pound of calcium chloride with the wearing surface aggregates.

During the past year we have added to this section 136 cubic yards of lime dust binder, 408 cubic yards of limestone aggregate (100% passing one inch square opening) and one pound per square yard of calcium chloride (applied in two applications of one-half pound each).

We have not been able to keep the road dustless, which we conclude is because of the thinness of the constructed crust. Another reason may be that we delayed application of treatment, waiting for needs to be more apparent, and when the needs appeared our atmospheric conditions were devoid of moisture. This road is showing up a little dusty on sunny days.

Section on County Trunk Road C.—This traverses a gently rolling blow sand country, several miles from the village of Conesville. Total length of this section is 1.4 mlies; wearing crust width, 24 feet; P.I. of the mixture is 10. No salvaging of the old surface was done on this section and we used the gravel and clay mix exclusively. The theoretical thickness was computed at 3 inches.

There was one ½-pound per square yard application of calcium chloride given this surface, yet in early summer of this year the surface became rough and corrugated; some sections much more so than others. There seemed to be insufficient binder to hold the top material, which had to resist the abrasive action of traffic resulting in an accumulation of loose aggregate on the surface varying in amount from a very thin layer to 1½ inches. We bladed all of this loose material to one side into a windrow, then equalized the windrow as best we could with the blade. Measurements were then taken of the windrowed aggregate in sections in keeping with an appreciable change in volume and 10 per cent of clay by volume was placed on the opposite side of the road, pulverized and then mixed with the windrowed aggregate, after which it was bladed over the surface of the road, care being

taken to maintain our "A" crown. A one-half pound surface treatment of calcium was then applied. The road is in fine condition today.

We conclude that our corrugating trouble was, to a large extent, due to the lowering of the P.I., caused by subgrade sand becoming mixed in with the surface mixture.

Conclusions pertaining to "Type 2"

We believe that salvaged materials secured from old gravel crusts are a valuable product. The crust should not be constructed less than 3 inches thick and watering should be provided for during process of compaction. The first calcium chloride applications at the time of construction should be incorporated into the mix at not less than one-half pound per inch thickness per square yard. Necessary future applications will be less if this is done. Also future applications had better be made too soon, rather than too late, and then only in periods of high humidity. It must be remembered that high humidity periods are rare in the summer.

A 3-inch base on a dirt road is not sufficient to carry a bituminous wearing surface. The thickness should first be increased to about 5 inches. It is less expensive and easier to get a dustless road with gravel and clay than with limestone and dust. The P. I. of the mixture should be increased over 10 if the areas through which the road traverses are the light sandy types of soils.

Results with "Type 3"

Next, I will discuss the one-half mile section of "type 3." This extends a half mile north out of the City of Muscatine, through an industrial area. The old crust on this road may be as much as a foot thick and the materials applied were never graded as to size. We made three ½-pound applications of calcium chloride during 1940; we have continued to have slight dust and corrugating conditions, but in contrast to these conditions before treatments of calcium chloride, the road is considered excellent. It formerly was impossible to provide a smooth road for over a few hours after dragging.

Conclusions as to "type 3" are.—Surface applications with calcium chloride to roads of this simple cut-and-try type are justified if dust and corrugations reach the stage of a nuisance, because of heavy traffic and annoyance to adjoining residences.

General conclusions as to the "A" crown.—The crown, under no condition, should be less than one-half inch per foot and should rather exceed this amount than be under.

City Not Liable for Drowning in Sewer

In an action for the death of a child drowned in a sewer the Georgia Court of Appeals (Rogers v. City of Atlanta, 6 S.E. 2nd 144) affirmed judgment dismissing the petition on demurrer because the municipality is not liable for damages to persons resulting from the judgment on the part of the authorities in locating or planning a general plan of drainage for the city and the petition did not allege the negligent failure to keep in repair or maintain the sewer or its drains, or negligence in allowing the sewer to become obstructed. The effect of the petition was merely to allege negligence in connection with the size and location of the inlet or opening into the sewer. It did not allege "negligent construction" of sewer or inlet, but only that the inlet was too small.

Head house of Sacramento, Calif., water supply.

The Waterworks Digest

Abstracts of the main features of all important articles dealing with waterworks and water purification that appeared in the previous month's periodicals.

Well Reclaimed With Dry Ice

At Knoxville, Ia., a well with 24" screen and 36" casing 47 ft. deep clogged in 1935 and two attempts at cleaning it by agitation and surging failed. In Dec. 1939 it was reclaimed by the dry ice method, producing 550 gpm with a 6 ft. drawdown. The dry ice was applied as follows: A horizontal wooden trapdoor was fastened in the well 3 ft. below the top, and a steel cap bolted on top of the casing. Through a 6" pipe welded to the top of the cap 450 lb. of dry ice was fed onto the trapdoor, the pipe closed and the trapdoor tripped, dropping the dry ice into the well. In four minutes a gauge in the 6" pipe registered 90 lb., then dropped to 20 lb., stood there for 1½ hrs. then dropped to zero. Between 5,000 and 6,000 gal. of water and sediment was pumped out. Then 400 lb. of dry ice was dropped in and the pressure rose to 20 lb., and after 60 hrs. more then 2 bushels of fine sand was baled out. The well was then surged and pumped 1½ days and all sediment removed.[F41]

Hot Water For Lime Slaking

At Ypsilanti, Mich., lime for softening was at first slaked with water from the mains at 52°F and slaker temperature could not be raised above 135° and 28% of calcium oxide was not hydrated. Water at 118° is now being used and slaker temperature is about 189°, and unhydrated calcium oxide has fallen to 6%; it is thought that if retention time could be increased, complete hydration would be approached.[F47]

Oil-Lined Reservoir Embankment

Pasadena, Calif., has built two reservoirs in cut and fill in which the inner 8 ft., from bottom to top of reservoir, is made with earth mixed with road oil; this being where good embankment material was not available. Although this increased the cost by 15 to 20% it was considered worth while because of complete elimination of leakage. In construction, excavation was started by removing the earth around the inner slope of the reservoir back 8 ft. from the finished face, leaving the center of the reservoir unexcavated; and carrying the excavation 24 to 30 in. below finished bottom grade. Then an oil-earth embankment was carried up 10 ft. wide (2 ft. inside the finished slope surface). When ground level was reached, the 10 ft. oil-earth lining and ordinary moist earth for the remaining width of the fill were carried up together to the top. For all the embankment, earth was used from the unexcavated center of the reservoir; this eliminating double handling of the material. After the embankment had been completed and excavation to a level 24 to 30 in. below floor level, 2 ft. was cut off the bank face (back to finished grade, to remove material not fully compacted) and this material spread on the bottom and rolled.

In making oil-earth fill, oil known as SC-2 was used. The earth was spread in layers not more than 4" deep, loosened with a harrow, road oil applied and cut in with a spring-tooth harrow, then more oil added as necessary, and mixed with spring-tooth and disc harrows; then rolled with a petrolithic tamper. An average of a barrel of road oil to 1.4 cu. yd. of fill was used, but fine soils require considerably more than sandy ones.[A66*]

HOW TO FIND ORIGINAL ARTICLES. Key letter at end of each digest refers to name of publication listed in bibliography at end of this section. Numeral indicates title of article.

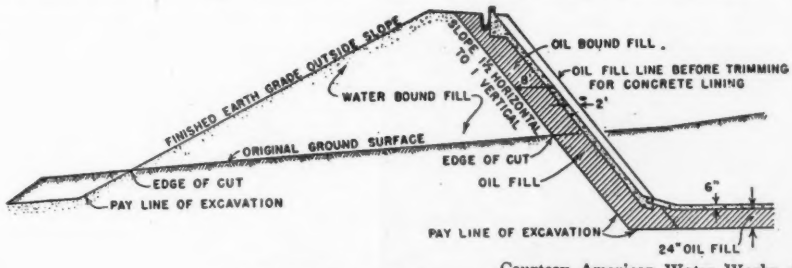
Unsolved Corrosion Problems

The author believes that "Much of the confusion that exists in the field of corrosion control at present results directly from the too ready acceptance of unproved theories and methods. . . . Many of the practices already adopted as standard are really far from valid, established procedures." "The simple pH test has done more harm than good." Grouping 50 waters from various sources according to whether they were actually extremely corrosive, moderately so, or non-corrosive and analyzing them "upset much of the beautiful theory of pH control, effect of carbon dioxide and supersaturation of calcium carbonate," but demonstrated that the lower the magnesium sulfate the less corrosive the water, and the greater the increase of hardness over alkalinity, the greater was the corrosion. "Factors tending to reduce corrosion are as follows: (1) low non-carbonate hardness or low sulfate content; (2) high alkalinity; (3) high silica content; (4) low carbon dioxide; (5) low oxygen concentration; and (6) low temperature." Well waters low in oxygen should never be aerated.[A69*]

Sodium Silicate And Flocculation

If sodium silicate be added to water properly, the floc particles are increased in size and (what is more important) definitely toughened. It is of little or no aid unless the raw water has a turbidity of 5 to 10 ppm, or unless floc has already begun to form. Silica is a deterrent to flocculation if applied when no suspended matter is present; within limits, the greater the turbidity the better the flocculation. Plant experiments are under way in which ½ to 1% of precipitated sludge is returned to the raw water, the sludge being "sweet" because of the use of carbon. The floc produced is tough, and will not readily disintegrate or peptize.[A70*]

*See Bibliography in the June issue.



Courtesy American Water Works Ass'n.

Typical section of oil-fill reservoir bank.

Clogging of Rapid Sand Filters

From experiments conducted at the Providence, R. I., filter plant it was concluded that the entire filter unit shares the burden of removing flocculated matter from the water. The upper portion performs most of the removal at the beginning of a run but the lower portions take part successively as those above become clogged, removal in the upper two inches approaching zero toward the end of the run. Throughout the length of each run, the lost head is directly proportional to time, but deviations from this may occur irrespective of the length of time necessary to complete the run.[A72*]

Relining Los Angeles Canal

At the head of Los Angeles aqueduct is 37 miles of open concrete-lined canal with 1:1 side slopes, 11 ft. bottom width and 11.25 ft. depth of water, constructed in 1911-13. The concrete lining was 6" thick, not reinforced, a locally made tuffa cement being used. There has been some spalling. Temperatures range from freezing to 110° F. Guniting proved no better than its bond to the old lining, and ½" thickness bonded much better than 2" or 3". Complete relining was begun in 1933, placing 5" of concrete on the old lining. The lower half of the side slopes and the bottom was lined first; then the canal partly filled and the top half placed from floating staging. All loose material was removed from the old concrete with pneumatic chipping hammers and strong water jets. Concrete was placed in 10 ft. panels between forms and screeded; the mix being 1:4 dry, finished with a coat of neat cement grout brushed on and steel troweled, and kept moist 14 days by sprinkling from a motor-propelled barge. Two concrete gangs were used, the second following the first after a sufficient time to permit the first alternately placed panels to set.[F51]

Spraying Copper Sulfate

The San Francisco Water Dept. distributes copper sulfate in its reservoirs by spraying a solution, using an 18 gpm turbine pump, drawing water from the reservoir through the bottom of the boat and forcing it through an injector which sucks up fine crystals of copper sulfate and discharging through 7 or 8 spray nozzles supported by a timber boom set crosswise of the boat, which moves about 6 mph. Spraying is found more effective in killing algae than was drawing sacks through the water; and requires 30% less frequent applications.[F62]

Steam in Mains Prevents Freezing

At Leadville, Colo., 10,000 ft. above sea level, frost occasionally penetrates below the water mains and, as the water enters the mains at approximately freezing temperature, freezing of mains results. To prevent this, steam is forced into the mains from 60 hp boilers at six points, raising the water temperature about 4°. A fireman is stationed at each plant, and three 8-hr. shifts maintained at two plants inside the town limits. During freezing weather every hydrant is flushed every morning, and thawed with a portable steam boiler if necessary; water from flushed hydrants being discharged into a sprinkler truck instead of onto the street.[F64]

Emergency Maintenance Equipment

The East Bay District, Calif., containing 540,000 population, receives water through 93 miles of aqueduct. For emergency maintenance it keeps on hand 30 ft. lengths of aqueduct pipe, portable welding machine, trench pumps, a truck crane carrying a ⅜ cu. yd. clamshell, a ½ cu. yd. power excavator with dragline or clamshell, a 1¼ cu. yd. power excavator with clamshell, dragline and shovel, and two portable air compressors. The distribution systems of the nine cities contain 44 booster pumping plants for serving high districts, all electric operated. To temporarily replace any of these that might break down, the district has a portable gas-engine-driven centrifugal pump with capacity of 460 gpm against 200 ft. head, which can connect its suction to a special connection in the lower service and its discharge to a special connection in the higher service.

Service trucks carry ten men, tools for unwatering trenches, air compressors, and ordinary tools and repair parts. Trucks

for night maintenance crews are painted white. Special welding units are kept on hand, consisting of a flatbed truck carrying a gas-engine-driven electric welding machine and oxygen and acetylene tanks for cutting.[E11]

Surface Washing Of Sand Filters

In spite of "high-rate" washing (really only about 4 ft. per min.), sand remains dirty and mud balls form. Surface wash of any kind remedies this in practically all cases. At Allentown, Pa., the Palmer agitator has been used on some of the filters since April, 1940. With this in use, mud balls were practically eliminated in five weeks and coating of sand grains materially reduced. No appreciable saving of wash water resulted; but with pre-chlorination, higher chlorine residuals resulted, little chlorine being removed by the clean sand, and lower chlorine doses are therefore possible. The cost of installation of an agitator should average abut $350 per mgd capacity, including all costs for labor and appurtenances.[G23]

Bibliography of Waterworks Literature

The articles in each magazine are numbered continuously throughout the year, beginning with our January issue.

c. Indicates construction article; *n,* note or short article; *p,* paper before a society (complete or abstract); *t,* technical article.

D *The Surveyor*
May 9

8. Water Waste Prevention in War Time. By T. A. Cecil. Pp. 311-312.

E *Engineering News-Record*
June 5

9. Canadian Waterworks Practice. By M. N. Baker. P. 77.

June 19

10. War and Water Service. By N. J. Howard. P. 83.
11. Trouble Shooters at Work. By J. S. Longwell. Pp. 84-86.
12. Control and Recording Devices. By P. Lippert. Pp. 87-88.
13. Interconnections Solve Supply Problems. By C. H. Capen. Pp. 89-90.
14. More Capacity With Clean Mains. By C. Inglee. Pp. 91-92.
15. Main Sterilization on a Defense Job. By H. J. Armbrust. Pp. 93-94.
16. Distribution System Diagnosis. By E. K. Wilson. Pp. 95-96.
17. Water for Fire Fighters. Pp. 97-98.

F *Water Works Engineering*
June 4

51. c. Relining Los Angeles Aqueduct. By B. S. Grant. Pp. 612-614.
52. New Diesels Cut Pumping Costs. By W. H. Gottlieb. Pp. 615-616, 637.
53. Copper Sulfate Applied as Spray for Algae Control. By E. P. Stewart. P. 617.
54. Wells Supply Hot Water. By D. Fetsch. Pp. 618-619.

June 18

55. Isolation of Coliform Group. By N. J. Howard. Pp. 694-697.
56. Good Management of Racine, Wis., Water Works. By L. R. Howson. Pp. 698-700.
57. Water Dept. Service Building at Racine, Wis. By W. A. Peirce. Pp. 701-704.
58. Colorado River Aqueduct Goes to Work. By D. J. Kinsey. Pp. 705-708, 712.
59. Operating Surface and Ground Water Supplies. Pp. 709, 769.
60. Deep Wells in Sandstone Rock. By L. A. Smith. Pp. 710-712.
61. New York City Cuts Pumping Costs. By T. Hochlerner and H. R. Sherman. Pp. 713-719, 759.
62. Copper Sulphate Spray Equipment. By N. A. Eckart. Pp. 727-728.
63. Maintenance Methods in Wilmington, N. C. By N. N. Wolpert. Pp. 736, 739, 740, 743.
64. Steam Heated Mains in Leadville, Colo. By M. W. Vawter. Pp. 744, 747.
65. Experiences at the World's Largest Filter Plant. By J. E. Kerslake. Pp. 748, 751, 752, 755, 756, 765, 766.
66. Lime Needed for Removing Hardness from a Water. By G. E. Hands. Pp. 779-780.

G *Water Works & Sewerage*
May

23. Filter Washing. By H. J. Krum and I. M. Glace. Pp. 189-195.
24. Water Hammer Correctives. By R. Bennett. Pp. 196-203.

J *American City*
June

13. Water Supply Development in Barranquilla, Colombia. By S. L. Hollopeter. Pp. 59-61, 71.
14. Red Water Stopped at Chappaqua, N. Y. Pp. 70-71.
15. Twenty-nine Years Operation of a Municipal Water Supply. Pp. 81, 107.

K *Proceedings, Am. Soc. of Civil Engineers*
June

2. Cost of Public Services in Residential Areas. By F. D. McHugh. Pp. 991-1022.

L *Civil Engineering*
June

4. Contamination of Ground Water Resources. By B. Harmon. Pp. 345-347.

M *Water & Sewage*
May

14. The Control of Cross-Connections. By G. A. H. Burn. Pp. 15-16, 27.

P *Public Works*
June

29. c. Seven Miles of Lock Joint Pipe at Portland, Me. By H. U. Fuller. Pp. 15-17.
30. Beautification of Water Works Grounds at Walhalla, S. C. By J. F. Bearden. P. 21.
31. Toxic Contaminants of Drinking Water. By L. T. Fairhall. P. 24.
32. Maintaining the Capacity of Water Mains. Pp. 28, 30, 32, 34, 36, 38, 41, 42-44.

W *Johnson National Drillers Journal May-June*
5. Development, Uses and Conservation of Ground Water. Pp. 1-7.
X *Journal, N. C. Sec., American Water Works Ass'n. Year of 1940*
40. Grounding Electrical Circuits to Water Service Pipes. By G. S. Rawlins. Pp. 37-42.
41. Results of Field Investigations of Grounding. By J. O. Coleman, W. R. Doar, P. W. Spence. Pp. 42-66.
42. Water Works Management. By D. M. Williams. Pp. 67-76.
43. Water Works Tools a Half Century Ago and Today. By W. W. Brush, Pp. 77- 1.
44. Transite Pipe. By H. Ickler. Pp. 82-90.
45. Cast Iron Pipe. By T. F. Wolfe. Pp. 90-95.
46. Reinforced Concrete Pipe. By F. F. Longley. Pp. 95-101.

Surface Water Diversion

A municipality has the duty to construct and maintain drains or outlets of sufficient capacity to carry off all water diverted from its usual flow, or where the area to be drained has been intentionally increased. But where there is no such diversion the municipality is not required to do more than take care of the usual and ordinary flow of water occasioned by rainfall or otherwise. Infrequent and extraordinary occurrences which cannot be foreseen and provided against create no obligation upon the municipality. Applying these general principles, the Maryland Court of Appeals holds (Eisenstein v. City of Annapolis, 9 A. 2d 224), that the municipality is not compelled to anticipate results of cloud bursts and unusual fall of water and is not liable for the increase in the flow of surface waters caused by the paving of streets and construction of curbing for sidewalks, where there is no intentional diversion or change in the drainage area.

Sewer Construction Contract Assuming Liability for Damage

In a contract for sewer construction the city exacted from the contractors a promise that they would be liable for any damages done to private property in connection with the work. The Minnesota Supreme Court (La Mourea v. Rhude, 295 N. W. 304) held that the owner of property damaged by the blasting operations of the contractors could recover on the contract. It was held immaterial that the obligation in the contract was also in effect to indemnify the city against claims for such damages. Discussing the doctrine of privity of contract, the court said that such discussion had no more than an academic value, because, the beneficiary's right to recover being established, with the resulting obligation of the promisor in his favor, there arose the relation of privity. Anyway, privity or no privity, it was held, the overwhelming weight of authority and the entire weight of all inherent factors of the problem spoke for recovery by this beneficiary.

Free Water From Municipal Waterworks

In mandamus proceedings by various hospitals, churches, educational departments and others to require the director of public utilities of a city to furnish free water to them as public, religious, benevolent, educational or charitable institutions, as required by city ordinances, the Ohio Supreme Court, in a 5 to 3 decision (State v. Hickey, 30 N. E. 2d 802) held that the only general restraints imposed on a municipality in the distribution of water are that the rates charged be reasonable and that there be no unjust discrimination among the customers served, taking into account their situation and classification. The court cited a number of cases holding or indicating that a municipality operating a waterworks possesses the power to supply water gratis to public, religious, educational or charitable institutions, and overruled demurrers to the petitions.

The dissenting opinion was to the effect that the giving of free water to the institutions was at least equivalent to a contribution of cash to their respective budgets, which was beyond the power of any municipality to do.

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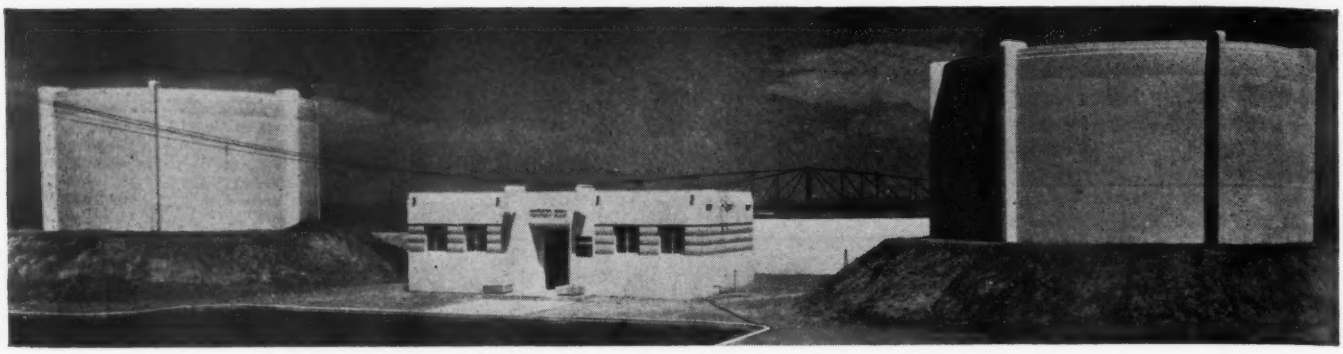


Huntington Beach, Calif., treatment plant; Currie Engrg. Co., consulting engineers.

The Sewerage Digest

Treating Brewery Wastes

After 8 months intensive field investigation on treating brewery wastes, including treatment with aluminum sulphate, ferric sulphate and lime, the Hays process (contact aeration) and trickling filters, a plant was designed for the Gulf Brewing Co. of Houston, Tex., consisting of two settling tanks, two trickling filters, a final settling tank, sludge digestion tank and 3 sludge beds. After 18 months of operation it was concluded that strong brewery wastes can be oxidized satisfactorily by series trickling filters, 95% removal of 24 hr. B.O.D. being obtained with a rate of application of 10 lbs. of B.O.D. per 1,000 cu. ft. of stone. The operation of the filters caused no unusual problems. Filter flies were controlled by applying 40 ppm of chlorine to the influent to the primary filter. The sludge digested satisfactorily.[X22]

Operation of An Activated Sludge Plant

Data on operation of the activated sludge plant of Marlboro, N. J., compiled during a five-year period from the basis of several observations: B.O.D. and suspended solids are readily reduced by this process; the reduction was not proportionate to the quantity of activated solids used, but if this was decreased below a minimum critical quantity, purification of sewage was impaired.

Good reduction in B.O.D. and suspended solids can be secured without high nitrification of the sewage or high D.O. residuals, the former of which is dependent on the latter.

Residual D.O. values as usually determined at a routine sampling point do not always indicate the presence of aerobic conditions throughout all parts of the aeration unit. For a given sampling point there will be a critical quantity of D.O. below which some parts of the unit may be anaerobic, this quantity depending on the hydraulic and air diffusion characteristics of the aerator. The maintenance of D.O. much above this critical value does not seem to bear any practical relation to the sewage purification.

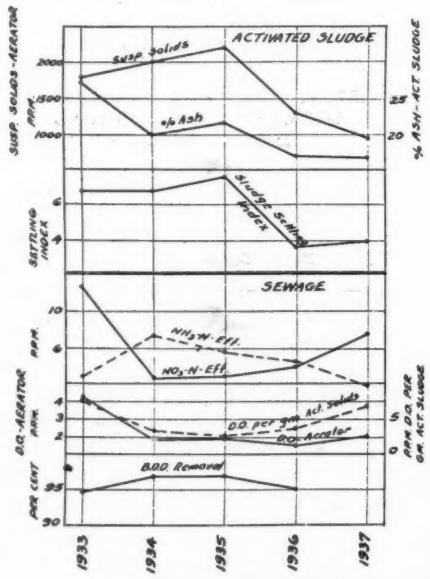
HOW TO FIND ORIGINAL ARTICLES. Key letter at end of each digest refers to name of publication listed in bibliography at end of this section. Numeral indicates title of article.

The amount of ash in the activated sludge does not seem to be a function of either high B.O.D. and suspended solids reduction or high nitrification.

The comparatively narrow range between winter and summer temperatures had no effect on sewage purification or sludge density, except a slight increase in ash of the activated sludge in summer.

No correlation was found between any chemical or physical indices of plant operation and settling characteristics of the activated sludge. The quantity of filamentous organisms was the only index that could be related to sludge settling.

Good purification results were secured with a dense and quick-settling activated sludge. The best purification was obtained with the lighter and more voluminous sludge containing high concentration of Sphaerotilus; but disposal of this type of sludge was difficult without the larger settling and digestion capacities required for sludge of this character.[C40]



Courtesy Sewage Works Journal

Average yearly operation results at Marlboro.

Chlorine Controls Activated Sludge Bulking

The Mansfield, Ohio, treatment plant was designed to use 0.3 cu. ft of air per gallon of sewage, with porous plate diffusion and paddle mixing, but use of less than 0.64 cu. ft. resulted in bulking, with sphaerotilus always present, and this amount was not always sufficient but was the maximum the plant could furnish. When bulking became too severe the sphaerotilus was removed by using 20 ppm of chlorine while reactivating; and it was found that growth of it could be prevented by daily use of 10 ppm. Chlorine was used also to supplement air when one of the blowers was temporarily out of commission.[X27]

Cathodic Tank Protection

Officials of six Ohio cities reported use of cathodic protection in 16 tanks, all satisfactory. The cost of operation was less than 30 cts. a month at Findlay, 31 cts. at St. Clairsville. In three cities the electrodes were broken by ice last winter but it was believed a method had been found for preventing this. In one case the use of cathodic protection removed all the paint from the tank, but the paint job had been a poor one.[X38]

Activated Carbon In Sludge Digestion

Laboratory and plant-scale experiments with activated carbon at the Lancaster, Pa., plant showed that the quality of digestion, as evidenced by the percentage of methane content of gas produced, was higher for activated-carbon-treated sludges than for sludges treated with hydrated lime. Also the drainability of the former was better and they produced better quality supernatant. The use of hydrated lime as a conditioning agent has its value but after optimum digestion reactions have been obtained it seems to be of little value.[G19]

Vacuum Filtration At Cleveland, Ohio

The type of filter cloths used is very important. Wool cloth costs about ten times as much as cotton but was used at first at Cleveland because ferric chloride was used alone for conditioning the sludge. Later, lime was used with the ferric chloride and the life of the wool cloths became so short that cotton was substituted and proved satisfactory. A chief difficulty is keeping clean the wire screens that support the filter cloths, as they become completely plugged with carbonate deposits. Sand blasting to remove the deposits abraded the wires. Tapping with a stiff brush was unsatisfactory. Dipping removed sections of screen in muriatic acid was effective but removing the screens bent or damaged them. Finally two methods were adopted; at the Westerly plant a rubberized cloth was suspended just under the drum, making a trough, which was filled with acid so that the lowest section of the filter was completely submerged; the filter was then revolved so that each section was submerged for a short time; 30 to 40 gal. of acid washed the 165 sq. ft. of filter in four hours. At the Southerly plant the acid is sprinkled over the top section of the drum, each section being brought to the top in succession and sprinkled; the filter is then washed with water and uncleaned spots given more acid. By this method 40 gal. of acid cleans 320 sq. ft. in eight hours.

The vacuum filtrate clogged pipe lines with lime and is now run into a lagoon, which is free of odors but somewhat unsightly.

Increasing the solids content of digested sludge gives less volume of sludge and vacuum filtrate to handle, saves in conditioning chemicals, gives greater filter yields, increased life of filter cloths, and less frequent cleaning of lime deposits from the filter screens. Cost of filtration per ton of dry solids in the sludge filter cake were, in 1939 at the two plants respectively: labor $3.32 and $1.65; lime, $0.91 and $1.20; ferric chloride, $1.07 and $1.36; other costs, $0.67 and $0.71; total, $5.97 and $4.92.[X23]

Sewage Treatment Trends in Ohio

Pumping. Improved and more efficient pumps have been developed for pumping sewage. A new feature is control by electrodes instead of floats.

Screens. It is surprising that mechanical devices eliminating hand raking have not been adopted more generally. Comminutors are especially advantageous where hand-raked bars would not receive regular attention.

Grease separators. The relatively small cost and successful operation of these at the small Bellefontaine plant should encourage the use of such device at moderate size plants.

Grit chambers. These, provided with mechanical devices for removing the grit, should be included in plants treating combined sewage because of the clean grit obtained, lack of labor required, small size of chamber required, and low operating cost.

Primary settling tanks. Probably no imhoff tanks will ever again be installed in a large plant, but tanks with mechanical sludge removers will be used instead. But imhoff tanks will still be used to some extent for small villages.

Chemical treatment. Development of mixing devices and sludge removers has aided in increasing the use of chemical treatment, which now occupies an established place for obtaining a degree of treatment higher than primary, reducing the loading on secondary treatment devices, and reducing installation cost by eliminating necessity for secondary treatment where treatment intermediate between primary and secondary would suffice.

Intermittent sand filters provide fairly satisfactory results for institutions and very small villages where secondary treatment is required, even where grossly neglected.

Activated sludge is the only method of obtaining complete treatment that is likely to be used in large cities, but has been adopted in a number of small ones where, the author thinks, other secondary treatment would have been more suitable.

Secondary fine-grain filters. There is a distinct field for polishing the final effluent of a plant. In addition to sand, good results have been obtained with grass filters, and there is a rather limited field for magnetite filters.

Sludge digestion tanks. At large plants there is an increasing tendency toward filtering undigested sludge, and tanks are used for storage of sludge rather than for digestion. For small plants, increased capacity of digestion tanks may be cheaper than heating them.

Sludge disposal in the 28 cities and 79 villages of Ohio is as follows: Open beds, 8 cities and 74 villages; covered beds, 11 cities and 5 villages; mechanical filtration 9 cities; incineration, 4 cities. The smallest community using mechanical filtration has 7,369 population. In the future, sludge filtration will be included in all very large plants.

Incineration should be p r a c t i c a l wherever filtration is and will probably be included in all future very large plants.

Chlorination is finding increasing use for odor prevention and assisting other plant processes as well as for additional purification or sterilization of plant effluents.[X21]

Liquid Sludge As Fertilizer

Battle Creek, Mich., has sold sludge as fertilizer for four years, advancing the price from $1.50 a load as a delivery charge in 1937 to $4 a ton plus delivery charge, or $5 if disintegrated with a Royer. Sludge beds became clogged with grain chaff, and to relieve them, use of liquid sludge was tried on a lawn with surprisingly good results, especially when thoroughly washed into the soil by sprinkling with water for several hours. A plant to handle the sludge was put together, consisting of a 600-gal. wood-stave tank and a 2" gasoline centrifugal pump, mounted on a truck. The pump filled the tank, then sprayed the sludge from tank over lawn through a 1½" hose. The price for so treating lawns is about $6.50 for one of average size. The only disadvantage is the odor and this is quickly removed by immediate watering. The results are so beneficial that Supt. Damoose believes wet sludge possesses some element other than nitrogen, phosphorus or potash that is conducive to very rapid and vigorous growth as well as prolific root propagation, and suggests it may be Vitamin B_1.[H28]

Determination of Sewage Grease

A method for determining total grease and non-saponifiable grease contents of fresh sewage solids, ripe sludge, activated sludge, humus tank sludge and scum has been worked out, employing the best features of former methods, giving consistent reproducible results with various sludges of different types. The solvent used is petrolic ether. Extraction of the dried sample is much more reliable than shake-out from wet samples. The Soxhlet type of extractor is recommended but there may be others as good. This method is probably not the ultimate in grease determination but its universal adoption would produce uniformity of results, which now is sadly lacking.[C34]

Other investigators, believing that evaporation to dryness after acidification "gives low results because of loss through steam distillation and resaponification of part of the fats by reaction with the concentrated metallic chlorides," developed a filtration method. The sample is strongly acidified, boiled, thoroughly chilled in a refrigerator, and filtered through filter paper overlaid with a cotton disc; filter paper and disc are dried in an oven and extracted in Soxhlet extractor, using petroleum ether. This "gives the most complete extraction and the most consistent results of all methods tried."[C35]

B.O.D. at Low Temperatures

Studies on the B.O.D. of diluted sewage and river waters at low temperatures led to four conclusions: 1—The first stage of the B.O.D. is well represented by the modified unimolecular relationship of Phelps and Theriault, when account is taken of the lag period. Exceptions to this occur in some experiments at and below 5°C, where there appears to be a secondary rise in the oxygen demand.

2—The value of k (the rate "constant" for the first stage B.O.D.) at a given temperature should be considered as a statistical average rather than as a true constant. In some polluted streams its value may be much lower than the generally accepted value, and in some sewages much higher, at least when they are incubated in standard dilution waters.

3—The effect of temperature on the values of k and L (ultimate or total B.O.D.) for the first stage are adequately represented by the equations developed by Theriault; but the numerical coeffi-

cients found in these studies differed somewhat from Theriault's, especially values of k at or below 5°C, being considerably lower than his.

4—The second or nitrification stage of the B.O.D. is greatly retarded at low temperatures and its development becomes uncertain and irregular. At the higher temperatures it can be formulated by the unimolecular relationship, with a lag period.[C44]

Bibliography of Sewerage Literature

The articles in each magazine are numbered continuously throughout the year, beginning with our January issue.

c. Indicates construction article; *n*, note or short article; *p*, paper before a society (complete or abstract); *t*, technical article.

C *Sewage Works Journal*
May

34. *t.* Determination of Total and Non-Saponifiable Grease. By H. W. Gehm and E. H. Trubnick. Pp. 467-484.
35. *t.* Investigation of Methods for Determining Grease in Sewage and Sludge. By D. Okun, E. Hurwitz and F. W. Mohlman. Pp. 485-491.
36. *t.* Comparative Digestibility of Scum and Sediment Obtained from Primary Tank Sludge. By C. E. Keefer. Pp. 492-497.
37. *t.* Hydrogen Sulfide in Sewage. By R. Pomeroy. Pp. 498-505.
38. Mechanical Flocculation and Bioflocculation of Sewage. by H. Heukelekian. Pp. 506-522.
39. Public Relations in the Construction and Administration of Sewage Works. By C. R. Velzy. Pp. 523-528.
40. Observations on Operation of the Activated Sludge Plant at Marlboro, N. J. By G. M. Ridenour. Pp. 529-541.
41. *t.* Dissolved Oxygen and B. O. D. Determinations: Their Application and Interpretation. By C. C. Ruchhoft. Pp. 542-550.
42. *t.* A Method for Computing the Oxygen Curve in a Polluted Stream, With Special Reference to the Oxygen Consumption by Sludge Deposits. By V. Jansa and G. Akerlindh. Pp. 551-556.
43. *t.* A Nomograph for Dissolved Oxygen Saturation in Water. By W. D. Hatfield. Pp. 557-560.
44. *t.* Long-Time Biochemical Oxygen Demand at Low Temperatures. By E. W. Moore. Pp. 561-577.
45. Electrical Equipment Maintenance: Summary of Practice. Pp. 579-586.
46. Extracts from Operation Reports at Green Bay, De Kalb and Buffalo. Pp. 587-598.
47. Maintenance of Sewage Treatment Works Equipment. By L. S. Kraus. Pp. 603-611.

D *The Surveyor*
May 2

13. *p.* Treatment of Trade Wastes. By M. E. D. Windridge. Pp. 297-299.

May 9

14. *p.* Treatment of Trade Wastes. By M. E. D. Windridge. Pp. 315-316.

May 16

15. Collection and Utilization of Kitchen Waste. By W. D. Benbow. Pp. 323-324.

G *Water Works & Sewerage*
May

17. *p.* Activated Sludge at Rockville Center. By C. G. Andersen. Pp. 204-207.
18. Water Pollution Abatement Problem of the Petroleum Industry. By R. F. Weston and W. B. Hart. Pp. 208-217.
19. Effect of Activated Carbon on Digestion. By G. J. Wiest. Pp. 235-239.

H *Sewage Works Engineering*
June

27. Concentration of Raw Sludge for Disposal at Sea. By L. E. West. Pp. 304-307.
28. Liquid Sludge, The Vitamin B, Fertilizer. By N. Damoose. Pp. 308-312.
29. *p.* Treatment of Meat Packing Plant Wastes. By G. L. Childress. Pp. 313-314.
30. Avoiding Errors in Handling Bacterial Samples. By F. G. Manning. Pp. 318-319.

J *American City*
June

16. *p.* Sewage Sludge for Soil Conditioning. By M. W. Tatlock. Pp. 91, 93, 95, 97.

M *Water & Sewage*
May

7. Typical Sewage Plant at London, Ont. By R. W. Garrett. P. 17.

P *Public Works*
June

26. Kansas City Saves $100,000 a Year on Garbage Collection. By C. A. Mahon. Pp. 22-23.
27. Steep Storm Sewers in Pocatello. By R. C. Lowrie. P. 27.
28. Operators Wanted for Army Sewage and Water Plants. Pp. 54-55.

X *Ohio Conference on Sewage Treatment*
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21. Recent Trends of Municipal Sewage Treatment in Ohio. By W. H. Knox. Pp. 14-23.
22. Operation of the Waste Treatment Plant of the Gulf Brewing Co. By S. L. Tolman. Pp. 24-34.
23. Vacuum Filtration and Incineration at Cleveland, O. By G. E. Flowers and W. E. Gerdel. Pp. 35-47.
24. Military Sanitation and the Sanitary Corps. By W. A. Hardenbergh. Pp. 48-53.
25. Rotary Distributors on Sand Filters. By H. A. Stepleton. Pp. 54-58.
26. The Safety Aspects of Sewage Treatment. By B. H. Barton. Pp. 59-64.
27. Experiences with Chlorine in the Control of Activated Sludge Bulking at Mansfield. By J. R. Turner. Pp. 65-69.
28. Routine Sampling and Analysis in Ohio Sewage Treatment Plants. By L. T. Hagerty. Pp. 70-74.
29. Effect of Milk Waste on Sewage Treatment at Marysville, O. By E. F. Wittmer. Pp. 75-82.
30. Estimation of Water Used for Cooling at Lima, O. By E. E. Smith. Pp. 86-90.
31. Report of Committee on Corrosion. By W. F. Schade. Pp. 91-92.
32. The Calendar and Clock Have Much to Do With Catch Sampling. By W. F. Crohen. Pp. 99-103.
33. Sewage Filtration. Discussion. Pp. 107-108.
34. Sewage Sludge Treatment and Disposal. Discussion. Pp. 109-111.

Keeping Up With New Equipment

Goodyear 24.00-32 Earthmover All-Weather Tread tires on La Plante-Choate 32-yd. scraper.

Off the Road Tires

Goodyear Tire & Rubber Co., Akron, Ohio

Four major product changes in its line of off-the-road tires for use in rugged service of construction and earth-moving jobs, pacing the increased demand for big equipment in all phases preliminary to national defense projects, are announced by The Goodyear Tire & Rubber Company.

The four new tires in its line are: a new Earth Mover All-Weather tread; Low-Pressure Sure Grip grader, and Hard Rock Lug, each designed for a specific task.

Standing nearly as tall as a man, the Earth Mover All-Weather in 24.00-32 size has a thicker tread upon which are larger non-skid buttons, whose design is carried nearly half-way down the tire's sidewall. The Earth Mover makes it possible to handle not only sand and soft dirt, but also shale and solid rock blastings with self-loading scrapers, because the tire equipment is now better armored and able to undergo terrific punishment.

The new tire's flotation, resistance to side slip and ability to clean itself have all been improved by the extra size, extra strength and alignment of its diamond button design. Button edges have been rounded to reduce snagging and chipping. New design Earth Movers are available in 14.00-20, 16.00-20, 18.00-24, 21.00-24 and 24.00-32 sizes.

Redesigned to put more effective power behind the grader blade, the company's Low-Pressure Sure Grip grader tire has a disconnected bar-type tread that delivers an extra 50 per cent traction, with no appreciable difference in rolling ability over the previous design. Sizes of the new Sure Grip grader: 9.00-24, 12.00-24, 13.00-24, 14.00-20, 10.00-24 and 13.00-20. The new type tread greatly improves the tire's traction in reverse, important factor in some kinds of work for which new attachments to late-model graders have been designed.

With flatter tread, whose bars are 50 per cent wider than on former tires, the new Hard Rock Lug has also greater protection against cutting and body injury over all its contact surfaces. This is the outstanding tire for rock excavation work, and other operations where cutting hazards are great.

Emergency Tractor Work

International Harvester Co., Chicago, Ill.

Heavy rains raised havoc with southern California's splendid highways. Dangerous rock and soil slides in the mountainous regions and flood debris of all kinds in the lower places necessitated a variety of emergency maintenance work. Crawler tractors of the type shown in accompanying illustration have been working overtime to get the roads into travel shape again.

The illustration shows an International TD-9 Diesel TracTracTor, equipped with ¾-yard hydraulically operated front-end Be-Ge shovel and owned by Ed Waters of Los Angeles, was rushed down to Highway No. 395, some five miles south of Elsinore, to remove from 700 to 800 yards of flood debris. Material was first moved to side of highway and then quickly loaded into trucks, as shown.

Another TD-9 International tractor owned by Santa Barbara county was used effectively for removing flood debris—sticky mud from Refugio Canyon road.

Motion Picture for Engineers and Officials

Cast Iron Pipe Research Assn., Chicago, Ill.

"Health and the Cycle of Water" is the title of a new moving picture produced for the Cast Iron Pipe Research Association by Audio Productions, Inc. of Long Island City, N. Y., and "dedi-

International TD-9 Diesel TracTrac-Tor.

cated to the State, County, City, and Township Health Officers, and the Consulting and Municipal Sanitary and Waterworks Engineers of America."

The film begins with some dramatic "small town" shots incident to the outbreak of a typhoid epidemic in the 1890's when stream pollution was more the rule than the exception. In depicting the "cycle of water" it shows water supply sources, former methods of purification, and sewage disposal or the lack of it.

There follows, by a combination of straight photography and animated diagrams, an excellent portrayal of modern plants and processes for the filtration of public water supply and the distribution of pure water to homes and industries. The cycle is completed by an equally detailed presentation of the operations of present-day sewage disposal plants. This part of the film deals both with the very large plants and the smaller ones which serve the average small municipality. Emphasis is placed not only upon their necessity and utility but upon the possibility of their being made veritable beauty spots as well.

While the film is informative and interesting for lay groups such as city councils, boards and committees, schools, clubs, etc., it is equally suited to technical audiences. This is especially true of the "trailer" reel, which is a separate technical reel, going into considerable visualization of the record of cast iron pipe in service and shows various laboratory and engineering tests.

Public officials and engineers confronted with the necessity of planning and approving installations of pipe for water supply lines and distribution mains, as well as filtration and sewage disposal plants, will find the new film helpful in picturing what scientific water works and sewage works engineering have done toward constant improvement.

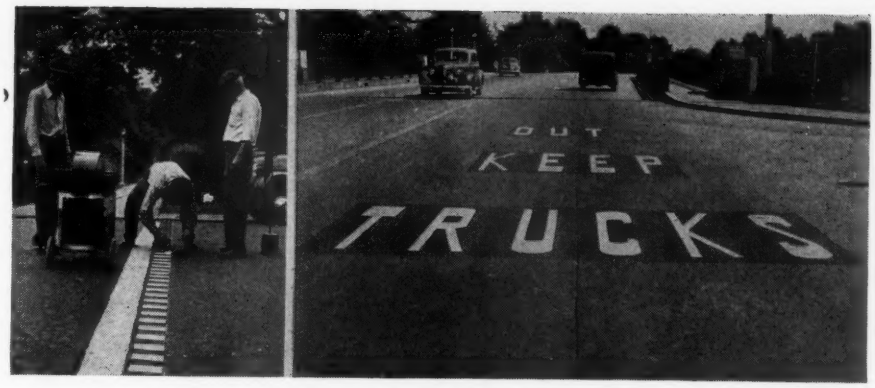
Inquiries regarding showings of the new film should be addressed to Cast Iron Pipe Research Association, Thomas F. Wolfe, Engineer, Peoples Gas Building, Chicago, Ill.

A Correction

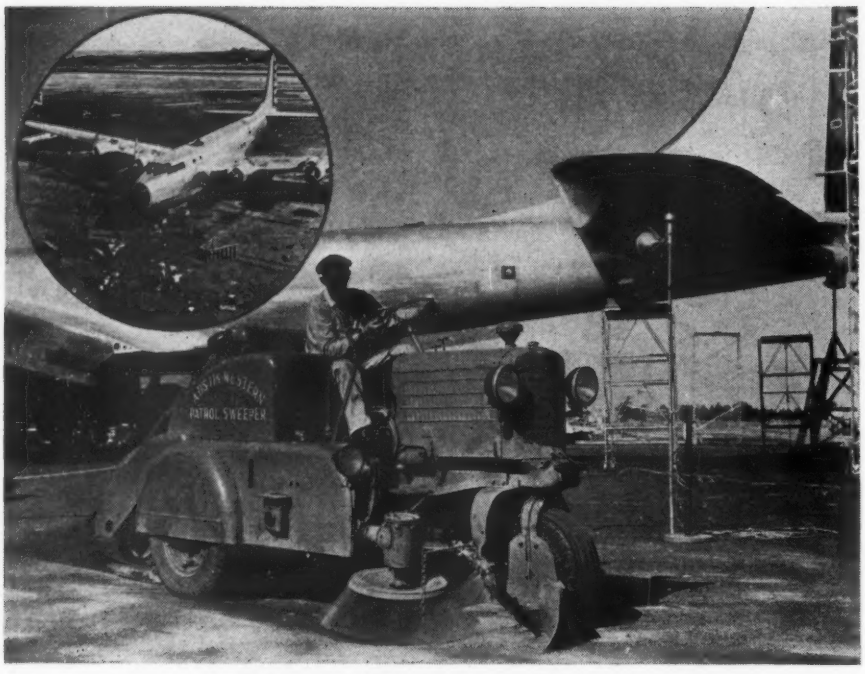
Armor-Flex Co., 4930 Fountain Ave., St. Louis, Mo.

This department erred in stating in the June issue that Armor-Flex Traffic Markers are made of linoleum.

The mistake was ours and the description issued by the manufacturer did not state that it was made of linoleum. On the other hand, it is described as a plastic devised after more than two years of research experimentation and trial. Before putting it on the market it was given a field test on a spot where the traffic count was 25,000 vehicles daily. It was watched through all seasons and it was only after Armor-Flex successfully withstood that gruelling trial that the product was offered to those responsible for traffic line marking.



Armor-Flex traffic markers.



Austin-Western Patrol Sweeper at Douglas Aircraft plant.

Army Uses Patrol Sweepers

Austin-Western Road Machinery Co., Aurora, Ill.

Only the most extravagant superlatives can fitly describe the Army's new B-19 bomber and flying fortress, the world's largest, shown here while rapidly nearing completion at the Douglas Aircraft Co., Inc., at Santa Monica, California. It's a super-charged, supercolossal, sub-stratosphere, air-conditioned, cannonading, armored ship, with a huge tail assembly that towers as high as a three-story building. In addition to a crew of 10, it can carry 125 armed men.

The giant gargantua weighs 82 tons and is capable of flying non-stop from Los Angeles to London with 18 tons of bombs and back again without refueling. Its armor and armaments are the most secret of secrets.

The wing spread of this huge air cruiser is 212 feet in length; its engines develop 8,000 horsepower; it uses an 11,000-gallon gas tank; has a 25-station telephone system and carries an auxiliary engine to produce enough electric power to operate a small industrial plant. Energy from the engine is used to operate the ailerons and raise the retractable wheels that weigh one ton each. In constructing the B-19, three million rivets were used.

No aluminum castings had ever been made as big as those required by this huge ship and there was no testing equipment capable of measuring the stresses and strains. A whole new engineering technique and method of handling had to be developed. Every precaution for the safety of the ship and the men was taken and every device or means that would promote efficiency was carefully investigated and employed—since crack performance in the air starts and stops with careful preparation on the ground.

An example of the vigilant attention given to details is shown by the care exercised to keep the hangars, approaches and runways clean and free from discarded bolts, small metal parts and stones which could be sucked up by the powerful propellers, and which might result in harm or injury to ship and men. To clean up these large areas fast and thoroughly, a patrol sweeper with dust-laying spray and revolving pickup brooms is used. (Recently the U. S. Army ordered 150 of these sweepers for use at its various flying fields.)

Surface Type Concrete Vibrator

Blaw-Knox Co., Pittsburgh, Pa.

This company has developed a concrete vibrator of the surface type which may be operated in conjunction with either its new paving spreader or its finishing machine. The unit is a practical aid to the paving constructor in preventing voids or segregation, in simplifying the finishing operations, and in facilitating the use of stiff mixes with coarse aggregates.

The vibrator pan is made of abrasion resistant steel, assembled with high tensile alloy steel bolts and lock nuts. While of light weight construction, the pan has a sufficiently deep section to obtain strength and rigidity; and this design assures that the energy from the vibrators will not be dissipated by excess inertia but rather transmitted into the concrete. The vibrators consist of unbalanced rotors mounted on the pan, two used for models accommodating up to 12 foot pavement widths and four on the full width machines. The center of gravity of the rotating member is readily adjustable to vary the amplitude of the vibration; the frequency, normally 4,200 per minute, is likewise adjustable.

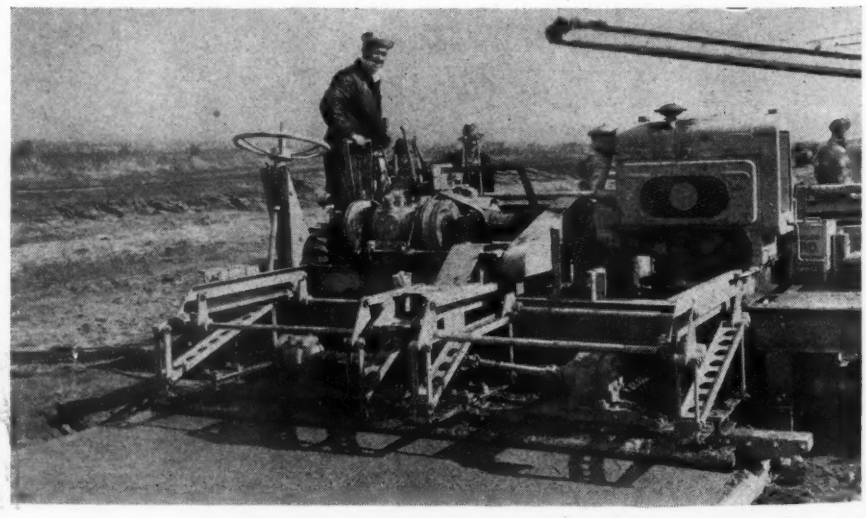
A significant characteristic of the unit is a free floating action that enables the concrete which accumulates to be fed beneath the vibrating pan and become incorporated in the slab. This self feeding quality is the result of the shape of the pan and the resilient suspension of the unit.

Tests under the observation of highway department officials have shown that the unit effectively communicates the effect of vibration over a wide area of concrete mix. In one such test on a Pennsylvania Highway Department project, a reed tachometer registered a frequency of 4,200 at a point 8 feet behind the vibrator. In another demonstration, vibration was observed 10 feet behind the unit. Write for bulletin No. 1825.

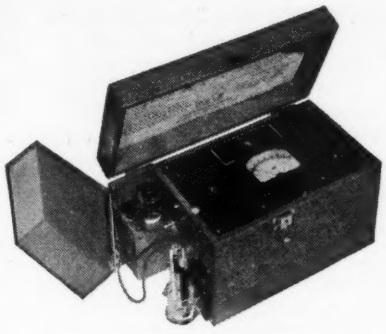
pH Indicator for Fast, Accurate Measurements

Leeds & Northrup Co., 4934 Stenton Avenue, Philadelphia, Pa.

Though simplified and stripped to essentials for low cost and easy operation, Leeds & Northrup's *new* Glass-Electrode pH Indicator offers as much



Blaw-Knox surface type concrete vibrator.



Leeds & Northrup pH Indicator

accuracy as is needed in many laboratory measurements and in practically all plant tests. It retains full accuracy up to 85 F in atmospheres of 95 per cent relative humidity. Measurements can be made consistently within its limit of error of adjustment, ±0.1 pH.

Light in weight, well balanced, it includes everything necessary for measuring pH. Speed and convenience are inherent in its simple construction. Adjustments take but a moment. Measurements are made simply by pouring a sample into its self-contained beaker, and reading pH directly from the meter.

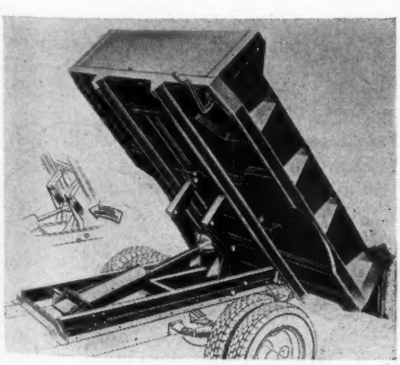
Adequately shielded, the instrument embodies a rugged deflection meter, and a thermionic amplifier of high stability. Manual temperature compensator (0 to 50 C, with 1-degree divisions) eliminates computations, saves time, prevents errors. Factory filled and sealed electrodes are highly stable. Strong, well-finished, mahogany case, of special construction, stands severe use and high humidity.

An 8-page illustrated catalog describing this new indicator is available, and has been sent to many sections of the L&N mailing list. If you failed to receive a copy, ask Leeds & Northrup Company for Catalog E-96 (2).

Improved Dump Body Hoisting

Anthony Co., Streator, Ill.

Old fashioned restraining chains and springs are now being replaced with Special Rubber insets (pat. pend.) newly developed by the Anthony Company, Streator, Illinois, manufacturers of Anthony Low Mounted Hydraulic Hoist Dump Bodies and used in their complete line of Super Hoist models to prevent both "over-run" and "kick back" (the inherent tendency of a dump body to rear over backwards) when dumping a load or spreading gravel. These Special Rubber insets give a new use for rubber in the manufacture of hydraulic hoist dump bodies. Light in weight and positive in operation they replace awkward, heavy chains and springs usually required in an attempt to control this evil. This new feature, as well as other outstanding Anthony features, such as Low Loading Height, "Push Pull" - Dash Control that works like choke button, Telescopic Subframe and Double Arm Power-Speed Hoist, is to be found in the complete Anthony line for 1941. For complete literature write Anthony Company, Streator, Illinois.



Anthony bodies use rubber insets.

Manufacturers Association Opens Headquarters

The Water and Sewage Works Manufacturers Association, Inc., is now in new headquarters at 22 East Fortieth Street, New York City, Room 3701-2. Telephone: LExington 2-1492. Arthur T. Clark, Manager.

Anchor Post Issues New Protective Fence Catalog

A new catalog showing protective fences of the chain link type has been published by the Anchor Post Fence Company, Baltimore, Md. It consists of 40 pages of text with 60 illustrations, showing fourteen different models.

PEOPLE . . . *Here and There*

Sewage Works Federation Second Annual Convention

Inspired by the outstanding success of its first annual convention held in Chicago last Fall, the Federation of Sewage Works Associations will stage its second annual convention in New York City on October 9, 10 and 11. Convention committees are already at work preparing for the meeting which will outdo the Chicago convention in size and scope. The convention will be held in conjunction with the regular Fall meeting of the New York State Sewage Works Association.

Operation of sewage treatment devices will be the keynote of the technical program and an entire session will be devoted to a symposium on operating problems. This feature will be augmented by papers of more general appeal to the sewage works profession presented by outstanding leaders from all parts of the country. The operation theme will be further advanced at a "sunrise breakfast" and round table discussion on topics of particular interest to sewage works operators.

While visiting the metropolis of America, the convention will be given the opportunity to inspect the vast sewage treatment facilities of New York City.

The convention headquarters will be the Hotel Pennsylvania where ample facilities will be provided for the country's largest Manufacturers' Exhibit of sewerage and sewage treatment equipment and materials. This equipment show will be one of the outstanding features of the convention.

The committee is not neglecting the social side of the meeting. New York City in October is an ideal shopping and theatre center. The Hotel Pennsylvania is located in convenient proximity to all centers of interest. The convention program will include a Smoker one evening and the Annual Banquet with entertainment and dancing on another evening. More complete details of the technical and social program will be provided in a later announcement.

New Prize Contest for Water Works Men Set by Penn Salt

A prize contest open to water works superintendents and engineers has just been announced by Pennsylvania Salt Manufacturing Company, Philadelphia, Pa.

The purpose of this contest is to obtain interesting case histories of emergency water purification with Perchloron, the high test calcium hypochlorite made by Penn Salt. Such case histories may deal with unusual conditions where normal chlorination has been rendered impractical because of flood or fire, pollution entering a water main at some inaccessible or not easily traceable point, accidental rupturing of mains, etc.

Prizes of twenty-five dollars ($25.00) will be awarded by Penn Salt for the most outstanding case histories involving emergency use of Perchloron. Authors of other reports deemed worthy of recognition but not meriting major prizes will receive prizes of five dollars ($5.00) each.

Entries in this contest are limited to a length of 500 words or less. The closing date for entries is October 1, 1941. Water works superintendents and engineers wishing to enter the contest should send their case histories as soon as possible to Pennsylvania Salt Manufacturing Co., 1000 Widener Building, Philadelphia, Pa.

R. J. Burns.

R. J. Burns Joins Pittsburgh Equitable Meter Company

Colonel W. F. Rockwell, President of Pittsburgh Equitable Meter Company, Pittsburgh, Pa., recently announced that Ross J. Burns had joined the company in the capacity of National Representative. Mr. Burns is well known in the water works field. For many years he was with the Badger Meter Manufacturing Company and previous to that connection had been in the plumbing and heating supply business. During World War I, he served in the United States Naval Aviation Corps.

Link-Belt Promotes Ewell and Woerwag

Mr. George L. Morehead, vice president in charge of eastern operations, Link-Belt Company, announces that Mr. Laurence M. Ewell has been appointed general manager of eastern division operations, with headquarters in Philadelphia.

Mr. Ewell, who has until now been export manager, and manager of the company's New York office, will be succeeded in that position by his very able assistant, Mr. Carl A. Woerwag, with headquarters in New York as heretofore.

Mr. Ewell, a graduate of the Link-Belt engineering department, entered the employ of the company in Philadelphia in 1906, and advanced successively through the drafting and estimating departments. Later he was transferred to the sales department; sent to the Pittsburgh office in 1911, and in 1915 returned to the Philadelphia plant sales department. Since that time, he has been constantly employed in the sales department, variously as sales engineer and branch manager of Link-Belt offices in Philadelphia, Chicago, St. Louis, and New York.

Carl Woerwag entered the employ of the company at Philadelphia in 1910, in the drafting room.

In 1914 he became squad engineer in charge of boiler plant and gas house conveyor work. He left Link-Belt in 1917 and became an ordnance inspector in the U. S. Army, returning to the company in 1919, as sales engineer in the export department, with headquarters at the New York office.

New Appointments

City Engineers recently reported include:

C. M. Pfennig, Bristol, Conn.
John O. Lilly, Quitman, Ga.
Walter J. Buchele, Iowa City, Iowa.
John Berry, Fort Scott, Kan.
J. A. Roby, Garden City, Kan.
Ray R. Harden, Garnett, Kan.
William R. Walters, Frederick, Md.
K. L. Chrysler, Billings, Mont.
E. D. Drake, Kimball, Nebr.
Dick G. Pepin, Pampa, Tex.

Water Works Superintendents recently appointed:

B. W. Harrell, Bainbridge, Ga.
C. A. Page, Moultree, Ga.
C. S. Layson, Harlan, Ky.
Henry Lesoine, East Stroudsburg, Pa.

The following are new county engineers:

A. J. Waters, Murray Co., Chatsworth, Ga.
Ross Harlin, Noble Co., Albion, Ind.
Robert Brown, Carroll Co., Delphi, Ind.
Charles Shearer, Allen Co., Ft. Wayne, Ind.
Paul R. Brown, Marion Co., Indianapolis, Ind.
Royal Pancake, Pike Co., Petersburg, Ind.
Carl L. Nicolay, Ellsworth Co., Ellsworth, Kan.
Frank D. Tyson, Rooks Co., Stockton, Kan.
Leslie T. Shepherd, Lebanon, Ky.
V. C. Hopple, Pike Co., Bowling Green, Mo.
A. J. Van Antwerp, Custer Co., Broken Bow, Nebr.
Ralph N. Hill, Lawrence Co., Ironton, Ohio.
J. E. Mock, Beaufort Co., Beaufort, S. C.

Readers' Service Department

These booklets are FREE. Use the coupon below or write the manufacturer direct, mentioning PUBLIC WORKS.

Construction Materials and Equipment

Asphaltic Limestone

5. Characteristics, methods of laying, and results with cold lay mixture shipped ready to use. Especially adapted to resurfacing old pavements, sealcoats and airport runways. Alabama Asphaltic Limestone Co., Liberty Nat. Life Bldg., Birmingham, Ala.

Bituminous Mixer

7. Exact control by volumetric proportioning. Continuous mixing and large capacity. The Barber-Greene mixer can be used as a unit of a travel plant or as a central plant. Excellent and instructive. Well illustrated book on request. Barber-Greene Co., Aurora, Ill.

Cold Mix Plants

10. New catalog and prices of Portable Bituminous Mixers in 6 to 14 ft. sizes for resurfacing and maintenance. Issued by The Jaeger Machine Co., 400 Dublin Ave., Columbus, Ohio.

Concrete Accelerators

30. "How to Cure Concrete," a forty-seven page manual published by the Dow Chemical Company, Midland, Michigan, treats fully subject suggested by title.

31. New 48-page booklet in five sections explains clearly the effects, advantages and methods of using Calcium Chloride and Portland Cement mixes. Complete and packed with practical information; well illustrated; pocket size. Sent free on request by Solvay Sales Corp., 40 Rector St., New York, N. Y.

33. Pocket manual of concrete curing with calcium chloride. Complete, handy. Contains useful tables, well illustrated. Write the Columbia Chemical Division, Pittsburgh Plate Glass Co., 30 Rockefeller Plaza, N. Y. C.

Concrete Mixers

44. Catalog and prices of Concrete Mixers, both Tilting and Non-Tilt types, from 3½S to 56S sizes. The Jaeger Machine Company, 400 Dublin Ave., Columbus, Ohio.

Drainage Products

71. Modern Culvert Practice — a 72 page book containing valuable data and tables will be sent promptly to anyone interested in drainage by Gohl Culvert Mfrs., Inc., Newport, Ky.

72. "3 Answers to Limited Headroom," a comparison of three ways of providing safe strength and adequate drainage under limited headroom. For copy ask Armco Drainage Products Assn., Middletown, Ohio.

Mud-Jack Method

107. How the Mud Jack Method for raising concrete curb, gutter, walls and street solves problems of that kind quickly and economically without the usual cost of time-consuming reconstruction activities — a new bulletin by Koehring Company, 3026 West Concordia Ave., Milwaukee, Wis.

Paving Materials, Bituminous

111. An excellent booklet issued by The Barrett Co., 40 Rector St., New York, N. Y., describes and illustrates the uses of each grade of Tarvia and Tarvialithic; 32 good illustrations.

Paving Materials, Brick

116. "New Developments in Brick Pavements." A review of the developments in brick pavements in recent years. Issued by the National Paving Brick Association, National Press Building, Washingon, D. C.

Pumps

121. New illustrated catalog and prices of Jaeger Sure Prime Pumps, 2" to 10" sizes, 7000 to 220,000 G.P.H. capacities, also Jetting, Caisson, Road Pumps, recently issued by The Jaeger Machine Company, 400 Dublin Ave., Columbus, Ohio.

122. CMC pump bulletin illustrates and describes complete line of modern centrifugals made in sizes from 1½" to 10" by Construction Machinery Co., Waterloo, Iowa.

123. New brochure by Gorman-Rupp Co., Mansfield, Ohio, illustrates and describes many of the pumps in their complete line. Covers heavy duty and standard duty self-priming centrifugals, jetting pumps, well point pumps, triplex road pumps and the lightweight pumps.

124. 16-page illustrated bulletin, SP-37, describes and illustrates complete C. H. & E. line of self-priming centrifugal pumps from ½" to 8", including lightweight models for easy portability. C. H. & E. Mfg. Co., 3841 No. Palmer St., Milwaukee, Wis.

Retaining Walls

126. Charts showing the design of cellular or bin-type metal retaining walls, helpful suggestions on their use for stabilizing slopes, preventing stream encroachment, and solving problems of limited right of way, and construction details are given in a 16-page bulletin entitled, "ARMCO Bin-Type Retaining Walls." It is published by the Armco Drainage Products Association, Middletown, Ohio, and member companies. Ask for Bulletin H-37.

Road Building and Maintenance

127. See road work as it was done in the 1890's and as it can be done by a full line of this year's road building equipment. See, in this new action picture book, the first reversible roller, 1893 World's Fair Award Grader and how methods have changed. Attractive new booklet AD-1796 recently issued by The Austin-Western Road Machinery Co., Aurora, Ill.

128. Motor Patrol Graders for road maintenance, road widening and road building, a complete line offering choice of weight, power, final drive and special equipment to exactly fit the job. Action pictures and full details are in catalogs Nos. 253, 254 & 255, issued by Galion Iron Works & Mfg. Co., Galion, Ohio.

129. New bulletins illustrate and describe the latest line of Littleford Utility Spray Tanks, Street Marking Units, Street Flushers and Kettles. Littleford Bros., 452 East Pearl St., Cincinnati, Ohio.

130. Toro patching rollers, tractors and mowers for parks, airports, estates, highways and golf courses are pictured and detailed in new illustrated booklet available from Toro Mfg. Co., Minneapolis, Minn.

Rollers

133. New Tu-Ton roller of simple construction for use in rolling sidewalks along highways, playgrounds and other types of light rolling is fully described in a bulletin issued by C. H. & E. Mfg. Co., 3841 No. Palmer St., Milwaukee, Wis.

138. "The Buffalo-Springfield line of road rollers (tandem, 3-wheel, and 3-axle) are described in the latest catalog issued by the Buffalo-Springfield Roller Co., Springfield, Ohio."

139. "Ironeroller" 3 Axle Roller for extra smooth surfaces on all bituminous work. Booklet contains roller data and operation details. Hercules Co., Marion, Ohio.

Spreader

147. Jaeger Paving equipment, including Mix-in-Place Roadbuilders, Bituminous Pavers, Concrete Bituminous Finishers, Adjustable Spreaders, Forms, etc.— 4 complete catalogs of latest equipment in one cover, issued by The Jaeger Machine Company, 400 Dublin Ave., Columbus, Ohio.

Soil Stabilization

150. "High-Service, Low Cost Roads" is one of the newer booklets using an effective combination of picture and text to set forth the principals and advantages of road surface stabilization with calcium chloride. Complete, interesting and well illustrated. 34 pages. Sent by Solvay Sales Corp., 40 Rector St., New York, N. Y.

152. The Columbia Alkali Corporation, will be glad to furnish to anyone interested complete information dealing with Calcium Chloride Stabilized Roads. This literature contains many charts, tables and useful information and can be obtained by writing Columbia Alkali Div., Pittsburgh Plate Glass Co., 30 Rockefeller Plaza, New York City.

154. "Soil Stabilization with Tarvia" —An illustrated booklet describing The steps in the stabilization of roadway soil with Tarvia will be mailed on request by The Barrett Company, 40 Rector St., New York, N. Y.

Tractors

159. "International Diesel TracTracTors" is a 48-page catalog giving full details of TracTracTors, including action pictures with bulldozers, bullgraders, blade graders, wheel scrapers, elevating graders, etc. Sent promptly by International Harvester Co., 180 North Michigan Ave., Chicago, Ill.

Street and Paving Maintenance

Asphalt Heaters

198. Illustrated Bulletins 15 to 20 describe Mohawk Oil Burning Torches; "Hotstuf" Tar and Asphalt Heaters; Portable Trailer Tool Boxes; Pouring Pots and other equipment for street and highway maintenance, roofing, pipe coating, water proofing, etc. Mohawk Asphalt Heater Co., Frankfort, N. Y.

Dust Control

210. "How to Maintain Roads with Dowflake" is a new 58 page illustrated booklet of information on stabilized road construction. Includes specifications and several pages of reference tables from an engineer's notebook. Issued by Dow Chemical Co., Midland, Mich.

211. A complete booklet on dust control titled, "Dust Control and Road Stabilization," describes the use of Columbia Calcium Chloride for dust control purposes and stabilization of roads. Sent on request by Columbia Alkali Div., Pittsburgh Plate Glass Co., 30 Rockefeller Plaza, New York, N. Y.

212. "Are You Annoyed by Dust?" an illustrated circular telling how to prevent dust with calcium chloride. Sent free by Michigan Alkali Co., 60 East 42 St., New York, N. Y.

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7-41

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Readers' Service Department

(Continued from page 55)

Radio Communication, Two Way

250. Valuable information on how cities and towns all over the country have solved their radio communication problems is found in "Motorola Radio Communication Equipment." Write Galvin Mfg. Corp., 4545 West Augusta St., Chiccago, Ill.

Sprayers

280. Cutback sprayers with new "single unit safety control" and full control of all spraying operations from the nozzle are described and illustrated in new bulletin No. 190 W issued by Aeroil Burner Co., Box 599, West New York, N. J.

Street Markers

300. Street marking simplified by the use of modern, self-contained units capable of handling any kind of striping jobs is the subject of an illustrated bulletin giving also full details of new M-B Street Markers. Sent by Meill-Blumberg Corp., Box PW, New Holstein, Wis.

Snow Fighting

Plows

350. "Frink One-Way Sno-Plows" is a four page catalog illustrating and describing 5 models of One-Way Blade Type Sno-Plows for motor trucks from 1½ up to 8 tons capacity. Interchangeable with V Sno-Plow. Features, specifications and method of attaching. Carl H. Frink, Mfr., Clayton, 1000 Islands, N. Y.

Ice Control

351. "Make Icy Highways Safe for Traffic"—a new bulletin by Michigan Alkali Co., 60 East 42 St., New York, N. Y., tells how to use calcium chloride for modern ice control.

Sanitary Engineering

Activated Alum

354. "Technical Data on Activated Alum and Dustless Blackalum" points out the analytical side of Activated Alum and Blackalum. Write Activated Alum Corp., Curtis Bay, Baltimore, Md.

Aero-Filter

356. New illustrated bulletin gives complete information on design of Aero-Filters to provide high-capacity, uniform, raindrop application over the entire filter bed. Write Lakeside Engineering Corp., 222 West Adams St., Chicago, Ill.

Air Release Valves

357. Automatic Air Release Valves for water, sewage and industrial uses are described and illustrated in new catalog issued by Simplex Valve & Meter Co., 6750 Upland St., Philadelphia, Pa.

Analysis of Water

360. "Methods of Analyzing Water for Municipal and Industrial Use" is an excellent 94 page booklet with many useful tables and formulas. Sent on request by Solvay Sales Corp., 40 Rector St., New York, N. Y.

Activation and Aeration

376. A valuable booklet on porous diffuser plates and tubes for sewage treatment plants. Covers permeability, porosity, pore size and pressure loss data, with curves. Also information on installations, with sketches and pictures, specifications, methods of cleaning and studies in permeability. 20pp. illustrated. Sent on request to Norton Company, Worcester, Mass.

Cleaning Mains

381. "Let's Look Into the Matter of Water Main Cleaning" is an illustrated booklet outlining the advantages of water main cleaning and explains how it can be done quickly and inexpensively by The National Method. Write National Water Main Cleaning Co., 30 Church St., New York, N. Y.

382. "Reconditioning Large Water Mains" and "Cement Linings of Large Diameter Mains in Place" are two interesting pamphlets available from Centriline Corp., 140 Cedar St., New York, N. Y.

Cleaning Sewers

383. A 20-page booklet describes and illustrates a full line of sewer cleaning equipment—Rods, Root Cutters, Buckets, Nozzles and Flushers. Write W. H. Stewart (Pioneer Mfr. since 1901), Jacksonville, Fla., or P. O. Box 767, Syracuse, N. Y.

Corrosion Prevention

384. Enamels and coatings to protect pipe lines, sewage plant structures and equipment against corrosion. Recommendations for any problem. Wailes Dove-Hermiston Co., 17 Battery Place, New York, N. Y.

Feeders, Chlorine, Amonia and Chemical

387. For chlorinating water supplies, sewage plants, swimming pools and feeding practically any chemical used in sanitation treatment of water and sewage. Flow of water controls dosage of chemical; reagent feed is immediately adjustable. Starts and stops automatically. Literature from % Proportioneers, Inc. % 96 Codding St., Providence, R. I.

Filter Bed Agitator

388. 60-page booklet, "The Mechanics of Filter Bed Agitation," containing engineering data, technical information concerning surface wash and opinions of users will be sent promptly by Activated Alum Corp., Curtis Bay, Baltimore, Md.

Filter Plant Controllers

389. "The Modern Filter Plant" and the uses of Simplex Controllers for operation are described in a handy, 16-page booklet. Charts, data, curves and tables. Simplex Valve and Meter Co., 6750 Upland St., Philadelphia, Pa.

Fire Hydrants

390. Specifications for standard AWWA fire hydrants with helpful instructions for ordering, installing, repairing, lengthening and using. Issued by M. & H. Valve & Fittings Co., Anniston, Ala.

391. See listing No. 410.

Flow Meters

393. The primary devices for flow measurement—the orifice, the pilot tube, the venturi meter and others — and the application to them of the Simplex meter are described in a useful 24-page booklet (42A). Simplex Valve and Meter Co., 6750 Upland St., Philadelphia, Pa.

Gates, Valves, Hydrants

394. Gate, flap and check valves; floor stands and fittings. New catalog No. 34 gives detail information with dimensions for all types of new full line. M. & H. Valve & Fittings Co., Anniston, Ala.

395. Complete booklet with much worthwhile water works data describes fully Ludlow hydrants and valves. Sent on request. Ludlow Valve Mfg. Co., Troy, N. Y.

396. See listing No. 410.

Gauges

398. The full line of Simplex gauges for filtration plants are illustrated and described in catalog issued by Simplex Valve and Meter Co., 6750 Upland St., Philadelphia, Pa.

Hypochlorinators

400. New illustrated booklet W&T 357 describes this simple, inexpensive means of protecting small water supplies such as summer camps, hotels, swimming pools, dairies, etc., as well as for feeding chemical solutions in the water works plant. Contains typical installation sketches. Write "Wallace & Tiernan Co., Inc., Newark, N. J.

Manhole Covers and Inlets

402. Street, sewer and water castings in various styles, sizes and weights. Manhole covers, water meter covers, adjustable curb inlets, gutter crossing plates, valve and lamphole covers, ventilators, etc. Described in catalog issued by South Bend Foundry Co., Lafayette Boul. and Indiana Ave., South Bend, Ind.

Manhole Cover Silencers

403. New bulletin on Tapax for quickly ending noisy manhole covers and small sample free. Write Tapax Mfg. Co., 201 Hoyt Ave., Mamaroneck, N. Y.

Meters, Venturi

405. MS Meters for use with venturi tubes, flow nozzles, etc., in wall, panel, or floor mounting are covered in detail in catalog sent free by Simplex Valve & Meter Co., 6750 Upland St., Philadelphia, Pa.

406. New bulletin illustrates Builders Air Relay system of transmission for the Venturi Meter which is particularly useful for liquids containing suspended solids like sewage. Eliminates corroson, clogged pipes, etc. Write Builders Iron Foundry, Codding St., Providence, R. I.

Meters, Water

407. Complimentary bulletin W529 tells all about Pittsburgh IMO water meters, "the meters that wear in where others wear out." Write Pittsburgh Equitable Meter Co., Pittsburgh, Pa.

Pipe, Cast Iron

408. Handbook of Universal Cast Iron Pipe and Fittings, pocket size, 104 pages, illustrated, including 14 pages of useful reference tables and data. Sent by The Central Foundry Co., 386 Fourth Ave., New York, N. Y.

409. Cast iron pipe and fittings for water, gas, sewer and industrial service. Super-deLavaud centrifugally-cast and pit-cast pipe. Bell-and-spigot, U. S. Joint, flanged or flexible joints can be furnished to suit requirements. Write U. S. Pipe and Foundry Co., Burlington, N. J.

410. "Cast Iron Pipe and Fittings" is a well illustrated 44 page catalog giving full specifications for their complete line of Sand Spun Centrifugal Pipe, Fire Hydrants, Gate Valves, Special Castings, etc. Will be sent promptly by R. D. Wood Co., 400 Chestnut St., Philadelphia, Pa.

Pipe Forms

411. Making concrete pipe on the job to give employment at home is the subject of a new booklet just issued by Quinn Wire and Iron Works, 1621 Twelfth St., Boone, Ia., manufacturers of "Heavy Duty" Pipe Forms. Sent promptly on request.

Pipe, Reinforced Concrete

412. Literature describing the manufacture and installaton of Lock Joint Reinforced Concrete Pressure Pipe for water supply lines and sewer force mains. Lock Joint Pipe Co., Ampere, N. J.

Pipe, Transite

413. Two new illustrated booklets, "Tansite Pressure Pipe" and "Transite Sewer Pipe" deal with methods of cutting costs of installation and maintenance of pipe lines and summarize advantages resulting from use of Transite pipes. Sent promptly by Johns-Manville Corp., 22 East 40th St., New York, N. Y.

Pipe Joints, Sewer

415. How to make a perfect sewer pipe joint—tight, prevents roots entering sewer, keeps lengths perfectly aligned; can be laid with water in trench or pipe. General instructions issued by L. A. Weston, Adams, Mass.

Pipe, 2-inch Cast Iron

417. The new McWane 2" cast iron pipe in 18-foot lengths has innumerable uses in water and sewage work. Send for the new McWane bulletin describing this pipe, the various joints used, and other details about it. McWane Cast Iron Pipe Co., Birmingham, Ala.

Pumps and Well Water Systems

420. Installation views and sectional scenes on Layne Vertical Centrifugal and Vertical Turbine Pumps fully illustrated and including useful engineering data section. Layne Shutter Screens for Gravel Wall Wells. Write for descriptive booklets. Advertising Dept., Layne & Bowler, Inc., Box 186, Hollywood Station, Memphis, Tenn.

Meter Setting and Testing

430. The most complete catalog we have seen on setting and testing equipment for water meters—exquisitely printed and illustrated 48-page booklet you should have a copy of. Ask Ford Meter Box Co., Wabash, Ind.

Recarbonation

431. Bulletin describes stabilizing lime-softened water by recarbonation, discussing gas production, washing, compressing, drying, and applying the CO(2). International Filter Co., 325 West 25th Place, Chicago, Ill.

Sand Expansion Indicator

432. New bulletin gives full details of Simplex Sand Expansion Indicators for water plants. Write Simplex Valve & Meter Co., 6750 Upland St., Philadelphia, Pa.

434. Be assured of uninterrupted, constant automatic removal of screenings. Folder 1587 tells how. Gives some of the outstanding advantages of "Straightline Bar Screens" (Vertical and Inclined types). Link-Belt Co., 307 N. Michigan Ave., Chicago, Ill.

Steel Sheet Piling

435. Steel sheet piling to speed sewer jobs is covered in illustrated catalog containing complete production specifications. Write Dept. PW-2, The Union Metal Mfg. Co., Canton, Ohio.

436. "Metal Sheeting for Lower Average Job Costs" is a new bulletin about light weight sheeting you can use again and again. Issued by Armco Drainage Products Assn., Middletown, Ohio.

Sewers

437. "ARMCO Sewers" is the title of a 48-page booklet describing the structural and other advantages of ARMCO Ingot Iron. Paved Invert and Asbestos-Bonded pipe for storm and sanitary sewers. Design data and large charts will be found helpful by engineers engaged in the design or construction of sewers. Copies will be sent on request by the Armco Drainage Products Association, Middletown, Ohio, or its associated member companies.

Septic Tanks, Small

438. Septic Disposal Systems, Waterless Toilets, Multiple Toilets for Camps and Resorts, and other products for providing safer sewage disposal for unsewered areas are described and illustrated in data sheets issued by San-Equip Inc., 504 E. Glen St., Syracuse, N. Y.

Sludge Drying and Incineration

440. "Disposal of Municipal Refuse." Complete specifications and description including suggested form of proposal; form of guarantees; statements and approval sheet for comparing bids with diagramatic outline of various plant designs. 48 pages. Address: Morse Boulger Destructor Co., 216-P East 45th St., New York, N. Y.

441. Full information about Nichols modern, efficient gabage and refuse incinerators now available in the Basket Grate, Continuous Grate, Revolving Grate and Monohearth types will be sent promptly by Nichols Engineering and Research Corp., 60 Wall Tower, New York, N. Y.

442. Recuperator tubes made from Silicon Carbide and "Fireclay" Corebusters for maximum efficiency are described and illustrated in bulletin No. 11 issued by Fitch Recuperator Co., Plainfield National Bank Bldg., Plainfield, N. J.

443. Nichols Herreshoff incinerator for complete disposal of sewage solids and industrial wastes — a new booklet illustrates and explains how this Nichols incinerator works. Pictures recent installations. Write Nichols Engineering and Research Corp., 60 Wall Tower, New York, N. Y.

Swimming Pools

446. Data and complete information on swimming pool filters and recirculation plants; also on water filters and filtration equipment. For data prices, plans, etc., write Roberts Filter Mfg. Co., 640 Columbia Ave., Darby, Pa.

447. 40-page Manual on swimming pools. Includes swimming and pool layouts, specifications, etc., and details concerning Permutit Swimming Pool Equipment. Write The Permutit Co., Dept. G-4, 330 West 42 St., New York, N. Y.

Taste and Odor Control

450. Technical pub. No. 207 issued by Wallace & Tiernan Co., Inc., Newark, N. J., describes in detail taste and odor control of water with BREAK-POINT Chlorination, a method of discovering the point at which many causes of taste may be removed by chlorination with little or no increase in residual chlorine. Sent free to any operator requesting it.

Treatment

453. "Safe Sanitation for a Nation," an interesting booklet containing thumbnail descriptions of the different pieces of P.F.T. equipment for sewage treatment. Includes photos of various installations and complete list of literature available from this company. Write Pacific Flush Tank Co., 4241 Ravenswood Ave., Chicago, Ill.

455. New booklet (No. 1642 on Link-Belt Circuline Collectors for Settling Tanks contains excellent pictures; drawings of installations, sanitary engineering data and design details. Link-Belt Company, 2045 W. Hunting Park Ave., Philadelphia.

456. New 16-page illustrated catalog No. 1742 on Straightline Collectors for the efficient, continuous removal of sludge from rectangular tanks at sewarage and water plants. Contains layout drawings, installation pictures, and capacity tables. Address Link-Belt Co., 2045 West Hunting Park Ave., Philadelphia, Pa.

457. New illustrated folder (1942) on Straightline apparatus for the removal and washing of grit and detritus from rectangular grit chambers. Address: Link-Belt Co., 2045 W. Hunting Park Ave., Philadelphia, Pa.

458. "Sedimentation with Dorr Clarifiers" is a complete 36-page illustrated catalog with useful design data. Ask The Dorr Company, 570 Lexington Ave., New York, N. Y.

459. A combination mechanical clarifier and mechanical digester, The Dorr Clarigester, is explained and illustrated in a bulletin issued by The Dorr Company, 570 Lexington Ave., New York, N. Y.

460. This new 145 page illustrated chemical products book contains 55 pages of Tables, Factors and valuable Reference Data. Issued by General Chemical Co., 40 Rector St., New York, N. Y.

461. Preflocculation without chemicals with the Dorrco Clariflocculator in a single structure is the subject of a new booklet issued by The Dorr Company, 570 Lexington Ave., New York, N. Y.

462. Dorrco Monorake for existing rectangular sedimentation tanks, open or closed, is described and illustrated in a new catalog sent on request. The Dorr Co., 570 Lexington Ave., New York, N. Y.

Tunnel Liners

480. "Save Money with Armco *Light Duty* Tunnel Liner" is a bulletin you'll want if you are interested in economical, long lasting tunnels. Write Armco Drainage Products Assn., Middletown, Ohio.

Valves (See Gates, Air Release, etc.)

Water Works Operating Practices

490. "Important Factors in Coagulation" is an excellent review with bibliography and outlines of latest work done in the field. Written by Burton W. Graham and sent free on request to Activated Alum Corp., Curtis Bay, Baltimore, Md.

491. "Soft Water for Your Community" tells by means of many interesting pictures and text the advantages of soft water to any community. Ask for a copy from The Permutit Co., Dept. G4, 330 West 42nd St., New York, N. Y.

492. "Alkalies and Chlorine in the Treatment of Municipal and Industrial Water" is a new comprehensive survey filled with tables, charts, cost comparisons, etc., valuable to all who treat large volumes of water. Write Solvay Sales Corp., 40 Rector Street, New York City.

Water Service Devices

500. Data on anti-freeze outdoor drinking fountains, hydrants, street washers, etc., will be sent promptly on request to Murdock Mfg. & Supply Co., 426 Plum St., Cincinnati, Ohio.

For the Engineer's Library

Brief reviews of the latest books, booklets and catalogs for the public works engineer.

Mobile Paving Plant

Jaeger Machine Co., Columbus, Ohio

It describes and illustrates the Jaeger Auto-Paver—a truck mixer specially designed for concrete paving and the Jaeger Screw Spreader. The Paver can be mounted on almost any truck chassis including short dump trucks.

A number of Auto-Pavers can be used in place of a standard paver with the following advantages claimed by the manufacturers: 1—divides the concrete plant into a number of completely mobile units; 2—provides a steady production of concrete delivered to the Concrete Spreader for laying in 10 to 14 ft. widths; 3—permits one or more units to be diverted for pouring curb, approaches, bridges, etc., without stopping work on slab; 4—eliminates problem of 10 ft. widening, where specifications ban paver from center lane; 5—successfully handles the driest, harshest mixtures (has laid pavement of "no-slump" concrete); 6—is the lowest cost method known for road widening and equally useful for any other work which can be served advantageously by truck mixers.

The booklet is replete with illustrations of both the Auto-Paver and Spreader in use—write for a copy of this valuable 24-page booklet.

Tar and Asphalt Kettles

Littleford Bros., 453 E. Pearl St., Cincinnati, Ohio

In a new bulletin Q-1, 84-HD Maintenance Kettles are described and illustrated. Standard sizes are 75, 110, 165, 210, 315 gallons. Important features are: double heat circulation, strongly built for heavy service, oil fired heating system, mounted on rubber tires for fast trailing. When you are interested in tar or asphalt kettles write for this bulletin.

Smallest Buckeye Trenchers

Buckeye Traction Ditcher Co., Findlay, Ohio

Details of design and construction improvements to date on the Model 11 Utility Trencher are covered by a new bulletin, No. 4B-11, just issued.

The Model 11 is the smallest of the wheel type trenching machines and cuts trench from 11½″ to 22″ wide and up to 5½′ deep. It is widely used by municipalities, water and gas companies, telephone companies and pipeline contractors.

Copies of the bulletin will gladly be sent on request.

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